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APOLLO 8 MANEUVER ATTITUDES

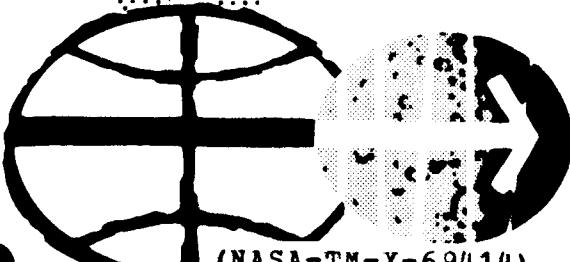
RELATIVE TO THE CELESTIAL SPHERE

AS VIEWED FROM THE SPACECRAFT

Flight Analysis Branch

MISSION PLANNING AND ANALYSIS DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS



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APOLLO 8 MANEUVER ATTITUDES RELATIVE TO
THE CELESTIAL SPHERE AS VIEWED FROM THE SPACECRAFT

By Charles T. Hyle and Alfred N. Lunde
Flight Analysis Branch

December 9, 1968

MISSION PLANNING AND ANALYSIS DIVISION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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CONTENTS

Section	Page
1.0 SUMMARY	1
2.0 INTRODUCTION	1
3.0 NOMINAL MISSION	2
4.0 HORIZON REFERENCE GO - NO-GO	3
5.0 LAUNCH WINDOW EFFECTS	3
6.0 PROGRAM ACCURACY	4
7.0 CONCLUSIONS	4
REFERENCE	

FIGURES

Figure		Page
1	The nominal Apollo 8 mission on a map of the celestial sphere	24
2	A schematic of the maneuver attitudes and lighting for the nominal mission.	25
3a	Launch date December 21, 1968; 72° launch azimuth: first opportunity. Begin TLI burn	26
3b	Launch date December 21, 1968; 72° launch azimuth: first opportunity. Middle of TLI burn	27
3c	Launch date December 21, 1968; 72° launch azimuth: first opportunity. End of TLI burn	28
4	Launch date December 21, 1968; 72° launch azimuth; first opportunity	
	(a) Translunar coast	29
	(b) Time from TLI cutoff = 10 hr.	29
	(c) Time from TLI cutoff = 20 hr.	30
	(d) Time from TLI cutoff = 30 hr.	30
	(e) Time from TLI cutoff = 40 hr.	31
	(f) Time from TLI cutoff = 54 hr.	31
5	Launch date December 21, 1968; 72° launch azimuth; first opportunity. Translunar coast (moon referenced)	
	(a) Time from TLI cutoff = 55 hr.	32
	(b) Time from TLI cutoff = 59 hr.	32
	(c) Time from TLI cutoff = 62 hr.	33
	(d) Time from TLI cutoff = 65 hr.	33
6	Star field and earth as observed prior to LOI	
	(a) 1 hour prior to LOI initiation.	34
	(b) 30 minutes prior to LOI initiation.	35
	(c) 14 minutes prior to LOI initiation.	36
	(d) 10 minutes prior to LOI initiation.	37
	(e) 8 minutes prior to LOI initiation	38
	(f) 2 minutes prior to LOI initiation	39

Figure		Page
7a	Launch date December 21, 1968; 72° launch azimuth; first opportunity. Beginning of LOI burn	40
7b	Launch date December 21, 1968; 72° launch azimuth; first opportunity. Middle of LOI burn.	41
7c	Launch date December 21, 1968; 72° launch azimuth; first opportunity. End of LOI burn	42
8a	Launch date December 21, 1968; 72° launch azimuth; first opportunity. Beginning of TEI burn	43
8b	Launch date December 21, 1968; 72° launch azimuth; first opportunity. Middle of TEI burn.	44
8c	Launch date December 21, 1968; 72° launch azimuth; first opportunity. End of TEI burn	45
9	Launch date December 21, 1968; 72° launch azimuth; first opportunity. Transearth coast (moon referenced)	
	(a) Time from TEI cutoff = 1 hr.	46
	(b) Time from TEI cutoff = 3 hr.	46
	(c) Time from TEI cutoff = 5 hr.	47
	(d) Time from TEI cutoff = 9 hr.	47
10	Launch date December 21, 1968; 72° launch azimuth; first opportunity. Transearth coast.	
	(a) Time from TEI cutoff = 14 hr	48
	(b) Time from TEI cutoff = 30 hr	48
	(c) Time from TEI cutoff = 40 hr	49
	(d) Time from TEI cutoff = 50 hr	49
	(e) Time from TEI cutoff = 60 hr	50
	(f) Time from TEI cutoff = 70 hr	50
	(g) Time from TEI cutoff = 78 hr	51
	(h) Time from TEI cutoff = 80 hr	51
11	Angle from LOI ignition attitude to moon horizon as a function of time to LOI ignition.	52
12	Angle from local horizontal to moon horizon as a function of time to LOI ignition	53

Figure		Page
13	Terminator visibility for December and January window	
	(a) Translunar injection	54
	(b) Lunar orbit insertion.	55
	(c) Transearth injection	56
14	Approximate lunar lighting conditions for the December window	57
15a	Launch date December 21, 1968; 90° launch azimuth; first opportunity. Beginning of LOI burn	58
15b	Launch date December 21, 1968; 90° launch azimuth; first opportunity. Middle of LOI burn.	59
15c	Launch date December 21, 1968; 90° launch azimuth; first opportunity. End of LOI burn	60
16a	Launch date December 21, 1968; 108° launch azimuth; first opportunity. Beginning of LOI burn	61
16b	Launch date December 21, 1968; 108° launch azimuth; first opportunity. Middle of LOI burn	62
16c	Launch date December 21, 1968; 108° launch azimuth; first opportunity. End of LOI burn	63
17a	Launch date December 23, 1968; 72° launch azimuth; first opportunity. Beginning of LOI burn	64
17b	Launch date December 23, 1968; 72° launch azimuth; first opportunity. Middle of LOI burn	65
17c	Launch date December 23, 1968; 72° launch azimuth; first opportunity. End of TEI burn	66
18a	Launch date December 23, 1968; 90° launch azimuth; first opportunity. Beginning of LOI burn	67
18b	Launch date December 23, 1968; 90° launch azimuth; first opportunity. Middle of LOI burn.	68
18c	Launch date December 23, 1968; 90° launch azimuth; first opportunity. Fnd of LOI burn	69

Figure		Page
19a	Launch date December 23, 1968; 108° launch azimuth; first opportunity. Beginning of LOI burn	70
19b	Launch date December 23, 1968; 108° launch azimuth; first opportunity. Middle of LOI burn	71
19c	Launch date December 23, 1968; 108° launch azimuth; first opportunity. End of LOI burn	72
20a	Launch date December 27, 1968; 72° launch azimuth; first opportunity. Beginning of LOI burn	73
20b	Launch date December 27, 1968; 72° launch azimuth; first opportunity. Middle of LOI burn	74
20c	Launch date December 27, 1968; 72° launch azimuth; first opportunity. End of LOI burn	75
21a	Launch date December 27, 1968; 90° launch azimuth; first opportunity. Beginning of LOI burn	76
21b	Launch date December 27, 1968; 90° launch azimuth; first opportunity. Middle of LOI burn	77
21c	Launch date December 27, 1968; 90° launch azimuth; first opportunity. End of LOI burn	78
22a	Launch date December 27, 1968; 108° launch azimuth; first opportunity. Beginning of LOI burn	79
22b	Launch date December 27, 1968; 108° launch azimuth; first opportunity. Middle of LOI burn	80
22c	Launch date December 27, 1968; 108° launch azimuth; first opportunity. End of LOI burn	81
23a	Launch date December 21, 1968; 90° launch azimuth; first opportunity. Beginning of TEI burn	82
23b	Launch date December 21, 1968; 90° launch azimuth; first opportunity. Middle of TEI burn	83
23c	Launch date December 21, 1968; 90° launch azimuth; first opportunity. End of TEI burn	84

Figure		Page
24a	Launch date December 21, 1968; 108° launch azimuth; first opportunity. Beginning of TEI burn	85
24b	Launch date December 21, 1968; 108° launch azimuth; first opportunity. Middle of TEI burn	86
24c	Launch date December 21, 1968; 108° launch azimuth; first opportunity. End of TEI burn	87
25a	Launch date December 23, 1968; 72° launch azimuth; first opportunity. Beginning of TEI burn	88
25b	Launch date December 23, 1968; 72° launch azimuth; first opportunity. Middle of TEI burn.	89
25c	Launch date December 23, 1968; 72° launch azimuth; first opportunity. End of TEI burn	90
26a	Launch date December 23, 1968; 90° launch azimuth; first opportunity. Beginning of TEI burn	91
26b	Launch date December 23, 1968; 90° launch azimuth; first opportunity. Middle of TEI burn.	92
26c	Launch date December 23, 1968; 90° launch azimuth; first opportunity. End of TEI burn	93
27a	Launch date December 23, 1968; 108° launch azimuth; first opportunity. Beginning of TEI burn	94
27b	Launch date December 23, 1968; 108° launch azimuth; first opportunity. Middle of TEI burn.	95
27c	Launch date December 23, 1968; 108° launch azimuth; first opportunity. End of TEI burn	96
28a	Launch date December 27, 1968; 72° launch azimuth; first opportunity. Beginning of TEI burn	97
28b	Launch date December 27, 1968; 72° launch azimuth; first opportunity. Middle of TEI burn.	98
28c	Launch date December 27, 1968; 72° launch azimuth; first opportunity. End of TEI burn	99

Figure		Page
29a	Launch date December 27, 1968; 90° launch azimuth; first opportunity. Beginning of TEI burn	100
29b	Launch date December 27, 1968; 90° launch azimuth; first opportunity. Middle of TEI burn	101
29c	Launch date December 27, 1968; 90° launch azimuth; first opportunity. End of TEI burn	102
30a	Launch date December 27, 1968; 108° launch azimuth; first opportunity. Beginning of TEI burn	103
30b	Launch date December 27, 1968; 108° launch azimuth; first opportunity. Middle of TEI burn.	104
30c	Launch date December 27, 1968; 108° launch azimuth; first opportunity. End of TEI burn	105
31a	Launch date December 21, 1968; 72° launch azimuth; second opportunity. Beginning of LOI burn	106
31b	Launch date December 21, 1968; 72° launch azimuth; second opportunity. Middle of LOI burn.	107
31c	Launch date December 21, 1968; 72° launch azimuth: second opportunity. End of LOI burn	108
32a	Launch date December 21, 1968; 108° launch azimuth; second opportunity. Beginning of LOI burn	109
32b	Launch date December 21, 1968; 108° launch azimuth; second opportunity. Middle of LOI burn.	110
32c	Launch date December 21, 1968; 108° launch azimuth; second opportunity. End of LOI burn	111
33a	Launch date December 27, 1968; 72° launch azimuth; second opportunity. Beginning of LOI burn	112
33b	Launch date December 27, 1968; 72° launch azimuth; second opportunity. Middle of LOI burn.	113
33c	Launch date December 27, 1968; 72° launch azimuth; second opportunity. End of LOI burn	114

Figure		Page
3 ⁴ a	Launch date December 27, 1968; 108° launch azimuth; second opportunity. Beginning of LOI burn.	115
3 ⁴ b	Launch date December 27, 1968; 108° launch azimuth; second opportunity. Middle of LOI burn	116
3 ⁴ c	Launch date December 27, 1968; 108° launch azimuth; second opportunity. End of LOI burn.	117

APOLLO 8 MANEUVER ATTITUDES RELATIVE TO THE
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1.0 SUMMARY

This report depicts star-field, earth-moon terminator and horizon orientations for the Apollo 8 mission as viewed from the spacecraft commander's window. In addition to providing an understanding of the geometry and backup attitude references, December launch window effects have been investigated.

2.0 INTRODUCTION

Because the geometry of the earth, moon, sun, and spacecraft constantly varies during a lunar mission, it is often difficult to visualize. When the launch window effects (different launch days, opportunities, etc.) are added, visualizing the problem becomes even more complex.

Since a knowledge of how the spacecraft should be oriented with respect to familiar objects visible from the spacecraft window would be invaluable for performing abort maneuvers as well as the nominal maneuvers, the primary objective of this report is to provide out-the-window views for the Apollo 8 mission.

Important secondary objectives are:

1. To establish possible backup attitude references for the major maneuvers; translunar injection (TLI), lunar orbit insertion (LOI); and transearth injection (TEI).
2. To provide moon reference horizon information to support an LOI GO - NO-GO.
3. To investigate lighting and geometry changes during the December 1968 launch window.

The major analytic tool used in producing this report was developed by the Computation and Analysis Division. Mr. G. B. Roush in particular is acknowledged for his support.

3.0 THE NOMINAL MISSION

The December 21, 1968, 72° launch azimuth, first TLI injection opportunity trajectory is the primary launch opportunity. This lunar mission trajectory has been plotted on a map of the celestial sphere (fig. 1) and shows the inertial positions of the spacecraft with respect to the stars, sun, and moon. Although it is not currently known how the sun affects the observation of stars from the spacecraft, an approximation of visible stars is indicated by the unshaded area of the figure.

A schematic of the nominal Apollo 8 trajectory as viewed from above the earth-moon plane showing spacecraft, pilot, and terminator orientation is presented in figure 2.

An out-the-window view from the commander's thrust position is shown for the nominal TLI ignition, midpoint of the burn, and end of burn in figure 3. The field of view from the top to bottom is 100° and the reticle shown has a 10° field of view. Visible stars are identified either by name or in the table at the top of the figure.

The earth as viewed while enroute to the moon during translunar coast (TLC) is depicted in figures 4(a) through 4(f). It is assumed that the spacecraft has been pitched so that it is pointing in plane toward the center of the earth. Passive thermal control attitudes were not investigated. Use of the terminator to establish the flight plane is seen to be perfectly feasible. This is especially useful for TLC aborts during which the earth always appears in the window field of view (ref.1).

At 55 hours ground elapsed time, as the trajectory approaches the moon's sphere of influence (MSI) the moon appears as shown in figures 5(a) through 5(d).

For the last hour prior to LOI ignition, it was assumed that the spacecraft was in an LOI(1) attitude. Associated window views are shown in figures 6(a) through 6(f). The occultation of the earth should be noted. Figures 7(a) through 7(c) show the terminator, horizon, and up to third magnitude stars which are visible at LOI ignition, midpoint of the burn, and end of burn. Of particular interest is the orientation of the constellation Orion and the fact that Betelgeuse is occulted during the maneuver. It is noted that all maneuvers (TLI, LOI, and TEI) are performed with the crew in a heads-down position (fig. 2).

Since TEI occurs in sunlight for the nominal mission, the stars shown in figures 8(a), 8(b), and 8(c) are obscured. It is noted that the sun is shining directly into the window for this burn. The transearth coast phase (TEC) is depicted in figures 9(a) through 10(h) showing the receding moon and then the approaching earth at various times.

4.0 HORIZON REFERENCE GO - NO-GO

As part of the general maneuver monitoring procedures recommended in reference 1, an externally referenced attitude check should be made prior to each maneuver. Although this is normally done using stars and the spacecraft optics several minutes prior to ignition, another convenient method will be used at LOI. It consists of checking the line-of-sight (LOS) angles to the horizon from the spacecraft X-body axis while the spacecraft inertially holds the LOI(1) attitude. This angle for the nominal trajectory and several opportunities is shown from an hour prior to LOI ignition through the burn in figure 11. Prior to ignition, the crew will measure the LOS angle to the lunar horizon using the crew optical alignment sight (COAS) and if this angle is not within $\pm 5^\circ$ of the required angle at that time, the crew will not perform LOI. The angle to the lunar horizon as measured from the local horizontal is shown in figure 12. An additional feature could be added to this procedure on later launch days; the angle from the X_b -axis to the terminator would provide a more accurate measurement. This is impractical on December 21 as the trajectory approaching the moon is in darkness.

5.0 LAUNCH WINDOW EFFECTS

The out-the-window views for a lunar mission are affected by (1) the launch day, (2) the launch azimuth, and (3) the TLI injection opportunity (first, second, or third). Maneuver ignition and end points for TLI, LOI, and TEI are shown relative to daylight and the terminator across the December 1968 and January 1969 launch windows in figures 13(a), (b), and (c). These figures depict whether the crew can see a lighted horizon in the maneuver attitude. Of primary interest are those launch days which have one of the maneuvers passing into or out of sunlight during the burn. Using figure 14 for orientation, this effect on LOI and TEI is shown in figures 15(a) through 30(c). These figures also show the launch azimuth effects. Because of difficulty in obtaining input data, TLI is not shown. Also, only the December window was investigated, because of similarities to the January window. Days and azimuths included are

December 21, 23, and 27, 1968, and 72° , 90° , and 108° , respectively. With the exception of the nominal LOI and TEI for December 21, all other LOI and TEI window views are in error by approximately 2° due to the use of burn targeting obtained with Lambert rather than external ΔV steering. Effects on views out the window during LOI due to a second opportunity TLI as well as day and azimuth are shown in figures 31(a) through 34(c). These figures may be useful when used in conjunction with reference 2.

6.0 PROGRAM ACCURACY

In the figures shown, the field of view is indicated in units, not degrees. The X-Y location of each star is shown on the top of the figure. A star catalogue (table I) identifies the stars appearing on all figures. The location of any specific star in the table can be approximately one unit off from the indicated location of the star. This is attributed to the fact that the program prints out the location of the star to the nearest unit. The field of view is 100° for TLI, LOI, and TEI (2° per unit). The TLC and TEC have a field of view of 30° . The view through the window is as seen by the commander's left and right eyes while he is sitting in a head-back position.

7.0 CONCLUSIONS

An understanding of spacecraft attitudes with respect to the sun, earth, moon, and stars is particularly useful in verifying maneuver attitudes normally described by IMU gimbal angles. This is especially true for Apollo 8 since IMU gimbal angles are referenced to several specific inertial orientations (REFSMMATS) instead of preferred platform alignments (non-zero IMU angles).

This report has presented numerous figures depicting the view from the Apollo 8 commander's window which include star-field, earth and moon terminator, and horizon orientations. This information should prove invaluable in assuring the crew that maneuver attitudes for both abort and nominal circumstances are correct.

TABLE I. - STAR IDENTIFICATION CATALOGUE

SEQ NO.	IDENTIFICATION	RIGHT ASCENSION			DECIMAL			DECLINATION			SEC.	MIN.	SEC.	MAH.	•	IDENTIFICATION			
		DEGREES	MIN	SEC	DEGREES	MIN	SEC	DEGREES	MIN	SEC									
1	33330	•0027500	0	0	9.9	-6.0286110	-6.0	31.0	31.0	0	4.06	30	PSC	•					
2	23	•03244444	0	0	56.8	-1.70530843110	-1.7	0	51.0	0	4.06	2	CET	•					
3	59	•05955555	0	0	32.6	-5.903333330	-5.	0	54.0	0	4.06	33	PSC	•					
4	127 ALPERATZ	SIRRATH	•11955555	0	6.0	34.4	28.697221100	28.	0	2.15	21	4	AND	•					
5	147 CAPH	•12163888	0.0	0	7.0	58.956666600	58.	0	57.0	0	4.06	42	11	CAS	•				
6	158	•12333333	0.0	0	38.4	-4.994555500	-4.	5	56.0	0	4.06	42	11	PHE	•				
7	238 ALGENIB	•19049999	0.0	0	25.8	14.989166600	14.	0	59.0	0	4.06	68	6	PEG	•				
8	272	•21438888	0.0	0	12.0	-19.126666000	-19.	0	7.0	0	4.06	7	CET	•					
9	334	•25427777	0.0	0	15.4	38.487499900	38.	0	29.0	0	4.06	24	J	AND	•				
10	362	•27861110	0.0	0	16.0	-36.591388800	-36.	0	15.0	0	4.06	25	S	AND	•				
11	388	•29405555	0.0	0	17.0	-9.01777770	-9.	0	1.0	0	4.06	3.75	8	CET	•				
12	401	•30435555	0.0	0	18.0	15.5	-65.0	-65.	0	4.0	4.06	0	Z	TUC	•				
13	503 ALGENIB	•39897221	0.0	0	23.0	56.3	-77.451388800	-77.	0	50.0	0	4.06	0	HYI	•				
14	516	•40803333	0.0	0	24.0	29.1	-43.873888800	-43.	0	52.0	0	4.06	3.90	K	PHE	•			
15	519 ANKAA	•40927777	0.0	0	24.0	33.4	-42.496111100	-42.	0	29.0	0	4.06	2.44	U	A	•			
16	625	•49931111	0.0	0	29.0	57.7	-63.0	-63.	0	9.0	0	4.06	0	W	TUC	•			
17	645	•50155555	0.0	0	30.0	59.6	62.0	62.	0	44.0	0	4.06	20	0	CAS	•			
18	729	•58346666	0.0	0	35.0	0.3	33.0	32.6	9.000	31.0	0	4.06	29	P	AND	•			
19	727	•58349999	0.0	0	35.0	0.6	53.0	50.7	44.000	53.	0	4.06	3.72	2	CAS	•			
20	759	•61166666	0.0	0	36.0	42.0	29.0	12.1944400	29.	0	7.0	0	4.06	30	E	AND	•		
21	774	•62416665	0.0	0	37.0	27.0	30.0	6.6972200	30.	0	40.0	0	4.06	3.49	31	D	AND	•	
22	792 SCHEDIR	SCHEDAR	•641121999	0.0	38.0	30.5	56.0	34.5833300	56.	0	20.0	0	4.06	2.47	18	A	CAS	•	
23	823	•661121999	0.0	39.0	40.5	46.0	27.694400	-46.	0	16.0	0	4.06	0	H	PHE	•			
24	866	•68664444	0.0	41.0	47.2	57.0	6.554999900	-57.	0	39.0	0	4.06	4.53	0	K	PHE	•		
25	885 DIPHDA	DENE8	•69722222	0.0	41.0	50.0	-18.17833300	-18.	0	10.0	0	4.06	2.24	16	B	CET KAITOS	•		
26	892	•71270000	0.0	42.0	45.9	48.0	9.89302500	-48.	0	5.0	0	4.06	3.70	42	0	CAS	•		
27	940	•75797221	0.0	45.0	28.7	24.0	0.7694400	24.	0	4.0	0	4.06	3.30	34	2	AND	•		
28	963	•78105554	0.0	46.0	51.8	7.0	7.395000000	7.	0	23.0	0	4.06	4.55	63	D	PSC	•		
29	962 ACHIRD	•78277776	0.0	46.0	58.0	57.0	6.39555500	57.	0	37.0	0	4.06	3.64	24	H	CAS	•		
30	989	•79791665	0.0	47.0	52.5	40.0	8.88861000	40.	0	53.0	0	4.06	4.42	35	N	AND	•		
31	1117	•90966666	0.0	54.0	34.8	60.0	52.777800	60.	0	31.0	0	4.06	2.30	27	G	CAS	•		
32	1122	•911333888	0.0	54.0	48.2	38.0	31.0000000	38.	0	18.0	0	4.06	3.94	37	H	AND	•		
33	1136	•92222221	0.0	55.0	20.0	23.0	2.29116600	23.	0	13.0	0	4.06	4.64	31	H	CET	•		
34	1172	•94866666	0.0	55.0	55.0	-29.0	5.454388400	-29.	0	32.0	0	4.06	4.39	0	A	SCL	•		
35	1258	•10187221	1.0	1.0	7.0	7.0	7.07222220	7.	0	42.0	0	4.06	4.43	71	E	PSC	•		
36	1288	•10599221	1.0	3.0	35.9	86.0	0.70565500	86.	0	4.0	0	4.06	4.54	43	B	CEP	•		
37	1335	•10754665	1.0	4.0	31.5	-46.0	9.05833300	-46.	0	54.0	0	4.06	3.45	50	U	PHE	•		
38	1384	•111385555	1.0	6.0	49.7	-10.0	3.6722200	-10.	0	22.0	0	4.06	3.60	31	H	AND	•		
39	1387	•111527777	1.0	6.0	55.0	-55.0	4.32499900	-55.	0	25.0	0	4.06	4.13	0	2	PHE	•		
40	1394	•12433332	1.0	7.0	27.6	47.0	0.55555500	47.	0	3.0	0	4.06	4.29	42	V	AND	•		
41	1400 MIRACH	•12946666	1.0	7.0	45.9	35.0	0.55555500	35.	0	8.0	0	4.06	4.43	43	S	CET	•		
42	1424 MIRACH	•149385554	1.0	8.0	57.5	54.0	9.6416600	54.	0	57.0	0	4.06	3.52	33	T	CAS	•		
43	1441	•16211109	1.0	9.0	43.6	29.0	9.0416600	29.	0	54.0	0	4.06	4.70	83	T	PSC	•		
44	1474	•19736110	1.0	11.0	50.5	24.0	3.9861100	24.	0	55.0	0	4.06	85	Y	PSC	•			
45	1591	•29222221	1.0	17.0	32.0	27.0	4.29222220	27.	0	50.0	0	4.06	4.67	90	U	PSC	•		
46	1695	•37119444	1.0	22.0	16.3	-3.0	3.63611100	-3.	0	21.0	0	4.06	4.83	45	J	CET	•		
47	1715 KSORA	KUCHA	•39185554	1.0	23.0	30.5	6.0	0.5414600	6.	0	3.0	0	4.06	4.37	51	U	AND	•	
48	1787	•44744442	1.0	26.0	50.8	-4.0	4.9722200	-4.	0	29.0	0	4.06	4.52	33	T	PHE	•		
49	1839	•49344443	1.0	29.0	36.4	1.0	1.65834320	1.	0	57.0	0	4.06	4.72	99	H	PSC	•		
50	1847	•49868331	1.0	47.7	47.7	-4.0	2.5416600	-4.	0	15.0	0	4.06	3.96	0	O	PHE	•		
51	1948	•57888888	1.0	34.0	44.0	4.0	4.23111100	4.	0	13.0	0	4.06	4.18	50	U	AND	•		
52	1966	•59719443	1.0	35.0	49.9	4.0	4.4516600	4.	0	19.0	0	4.06	3.77	51	U	AND	•		
53	1979 ACHERNAR	ACHERNAR	•60168888	1.0	36.0	24.0	-5.74141600	-5.	0	27.0	0	4.06	4.00	61	A	ERI	•		
54	2055	•66011110	1.0	39.0	36.4	5.0	5.31111110	5.	0	18.0	0	4.06	4.68	106	N	PER	•		
55	2102	•69096664	1.0	41.0	41.0	5.0	5.031303200	5.	0	30.0	0	4.06	4.00	0	V	PER	•		

56	2123	1.70736109	1.0	42.0	26.5	-16.12111100	-14.0	7.0	3.65	52	T
57	2139	BATEN KAITOS	1.72569442	1.0	43.0	32.5	8.98222220	8.0	58.0	110	PSC
58	2249	METALLAH MOTHALLAH	1.82886110	1.0	49.0	43.9	-10.51722210	-10.0	30.0	3.94	CET
59	2272	KAITAIN	1.85133332	1.0	51.0	46.8	29.74249900	29.0	44.0	33.0	55.7
60	2291	SEGIN	1.86008333	1.0	51.0	36.8	19.2277700	19.0	7.0	2.4	TRI
61	2289	SHERATAN	1.86424999	1.0	51.0	51.3	63.49861100	63.0	29.0	4.75	AKI
62	2303	ALGOL	1.87072220	1.0	52.0	14.6	-4.97361100	-46.0	25.0	3.44	CAS
63	2309	ALRUCABA	1.87836109	1.0	52.0	42.0	20.63777700	20.0	38.0	4.41	PHE
64	2331	ALRISHA	1.90074498	1.0	54.0	2.7	-67.81916600	-67.0	49.0	2.72	AKI
65	2339	ALRISHA	1.90999443	1.0	54.0	35.8	-51.78277700	-51.0	46.0	9.0	HYI
66	2369	ALMACH	1.92966665	1.0	55.0	46.8	-47.55555500	-47.0	33.0	0.0	ERI
67	2405	ALMACH	1.96111110	1.0	57.0	40.0	-61.73972100	-61.0	44.0	3.02	PHE
68	2419	ALMACH	1.97258331	1.0	58.0	21.3	-21.24466600	-21.0	14.0	0.0	HYI
69	2424	ALRUCABA	1.98409331	1.0	59.0	2.7	70.73861100	70.0	44.0	4.18	CET
70	2443	ALRUCABA	1.99004331	1.0	59.0	24.3	89.10222100	89.0	6.0	4.61	CAS
71	2452	KAITAIN	2.00388889	1.0	59.0	14.0	1.59555550	2.0	35.0	2.12	UMI
72	2445	KAITAIN	2.00675000	2.0	0.0	24.3	72.25333300	72.0	15.0	0.0	OKUA
73	2477	ALAMAK	2.02902770	2.0	1.0	44.5	42.16277700	42.0	12.0	4.06	CAS
74	2506	ALAMAK	2.04884740	2.0	2.0	55.3	-27.46416700	-29.0	27.0	2.26	AND
75	2538	HAMAL	2.0868320	2.0	5.0	11.7	23.29777700	23.0	17.0	0.0	FUR
76	2572	HAMAL	2.12422110	2.0	7.0	27.0	34.82250000	34.0	49.0	2.23	ARI
77	2656	HAMAL	2.19902770	2.0	11.8	8.5	8.68333330	8.0	41.0	4.06	TRI
78	2742	HAMAL	2.2537770	2.0	15.0	13.6	33.66338800	33.0	41.0	4.54	CET
79	2756	HAMAL	2.25430550	2.0	15.0	15.5	-51.67361100	-51.0	46.0	0.0	TRI
80	2796	HIRA	2.29221660	2.0	17.0	34.5	-3.13555550	-3.0	40.0	4.74	0
81	2872	HIRA	2.35200000	2.0	21.0	7.2	-68.41638800	-68.0	49.0	0.0	CET
82	2954	HIRA	2.42836100	2.0	25.0	42.1	-47.860227700	-47.0	51.0	4.44	OK
83	2952	HIRA	2.43888880	2.0	26.0	9.2	67.24666660	67.0	46.0	0.0	ERI
84	2960	HIRA	2.43242490	2.0	26.0	17.7	8.30416660	8.0	11.0	4.59	CAS
85	3192	HIRA	2.62808320	2.0	37.0	41.1	-17.861111	-17.0	25.0	0.0	ERI
86	3217	HIRA	2.64108330	2.0	38.0	27.9	-43.0411100	-43.0	8.0	2.00	CET
87	3240	HIRA	2.6507490	2.0	39.0	27.0	-68.41638800	-68.0	6.0	4.26	HYI
88	3237	HIRA	2.65474490	2.0	39.0	17.1	-40.004444400	-40.0	3.0	0.0	ERI
89	3273	KAFFALJIOHNA	2.68986110	2.0	41.0	23.5	27.55944490	27.0	33.0	0.0	ARI
90	3276	KAFFALJIOHNA	2.69141660	2.0	41.0	29.1	8.30916660	8.0	16.0	4.34	CET
91	3277	KAFFALJIOHNA	2.69261110	2.0	41.0	47.8	49.08166600	49.0	10.0	4.3	PER
92	3300	KAFFALJIOHNA	2.70758330	2.0	42.0	27.3	-14.00611100	-14.0	28.0	4.53	ERI
93	3309	KAFFALJIOHNA	2.71744440	2.0	43.0	2.8	-9.96750000	-9.0	58.0	3.0	CET
94	3318	KAFFALJIOHNA	2.72447210	2.0	43.0	28.1	-18.71972200	-18.0	43.0	4.39	PER
95	3356	KAFFALJIOHNA	2.76163890	2.0	45.0	49.1	29.10277700	29.0	6.0	4.36	ERI
96	3387	KAFFALJIOHNA	2.79374790	2.0	47.0	37.5	-32.55222200	-32.0	33.0	3.58	PER
97	3391	KIRAM	2.79863890	2.0	47.0	55.1	27.11750000	27.0	7.0	0.0	PER
98	3390	KIRAM	2.8013890	2.0	48.0	7.7	55.75166600	55.0	45.0	3.0	PER
99	3401	KIRAM	2.80411110	2.0	48.0	22.0	38.175830	38.0	10.0	3.93	PER
100	3419	KIRAM	2.82527170	2.0	49.0	21.1	34.91694900	34.0	55.0	4.27	PER
101	3463	KIRAM	2.84461100	2.0	50.0	40.6	-75.20999900	-75.0	10.0	4.67	ERI
102	3462	KIRAM	2.86572220	2.0	51.0	45.8	52.62055500	52.0	37.0	1.3	PER
103	3539	KIRAM	2.91191660	2.0	54.0	42.9	-9.0363890	-9.0	2.0	3.0	PER
104	3567	KIRAM	2.94191660	2.0	56.0	30.9	39.52398880	39.0	31.0	1.0	PER
105	3584	ACAMAR	2.94888880	2.0	56.0	56.0	-40.44416600	-40.0	26.0	2.22	PER
106	3582	ACAMAR	2.95341660	2.0	57.0	12.3	-21.20186900	-21.0	12.0	0.0	ERI
107	3595	ACAMAR	2.96391660	2.0	57.0	50.1	8.74888890	8.0	46.0	4.64	PER
108	3643	MENKAR	3.00744440	3.0	0	26.8	3.95361110	3.0	57.0	9.1	CET
109	3649	MENKAR	3.01413890	3.0	0	50.9	-23.76055500	-23.0	45.0	9.2	ERI
110	3664	ACAMAR	3.04747220	3.0	2.0	14.9	53.3708300	53.0	22.0	1.1	PER
111	3682	ACAMAR	3.04987770	3.0	2.0	55.6	38.7053300	38.0	42.0	2.30	PER
112	3733	GORGONA	3.09805550	3.0	5.0	53.0	40.8222100	40.0	49.0	2.30	PER
113	3740	GORGONA	3.10883330	3.0	6.0	31.8	49.46111100	49.0	52.0	4.17	PER

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

114	3755	MISAM	J.1187499U	3.0	7.0	7.5	44.72211UUU	44.0	43.0	43.0	4.00	27	K
115	3805	BUTEIN	J.1603888U	3.0	9.0	37.4	19.59555uuu	19.0	44.0	35.0	4.05	57	D
116	3831		J.1763888U	3.0	10.0	35.0	-2.9.124166uuu	-2.9.0	7.0	27.0	3.95	57	A
117	3979		J.2993055U	3.0	17.0	57.5	-21.884166uuu	-21.0	53.0	3.0	3.95	16	T
118	3981		J.3036111U	3.0	18.0	13.0	28.9221780U	28.0	55.0	22.0	4.72	0	PER
119	4000		J.30886100	3.0	18.0	31.9	-4.3.2027770U	-4.3.0	12.0	10.0	4.30	82	ARI
120	4041	MIRFAK	MARFAK	3.0	21.0	48.8	49.7383333U	49.0	44.0	18.0	1.90	33	EERI
121	4070		J.3821110U	3.0	22.0	55.6	8.9064444U	8.0	54.0	25.0	3.80	1	TAU
122	4107		J.42113880	3.0	25.0	16.1	9.6119445U	9.0	36.0	43.0	3.75	2	TAU
123	4113		J.43697210	3.0	26.0	13.0	59.8221777U	59.0	49.0	13.0	4.42	2	CAM
124	4133		J.44758320	3.0	26.0	51.3	48.0.U77777U	48.0	23.0	21.0	4.67	34	PER
125	4158		J.46822770	3.0	28.0	5.0	49.3891666U	49.0	34.0	4.00	4.55	35	S
126	4184		J.48222770	3.0	28.0	56.2	12.8180555U	12.0	49.0	5.0	4.28	5	TAU
127	4244		J.5213333U	3.0	31.0	16.8	-9.5755555U	-9.0	32.0	3.0	3.81	18	E
128	4258		J.5373333U	3.0	32.0	14.0	-21.791666U	-21.0	34.0	57.0	4.34	19	ERI
129	4287		J.56655550	3.0	33.0	59.6	59.8221777U	59.0	49.0	13.0	4.42	2	CAM
130	4313		J.5847499U	3.0	35.0	5.0	*291666666	*0	17.0	30.0	4.40	34	PER
131	4329		J.59727770	3.0	35.0	50.2	-40.0.38611UU	-40.0	23.0	19.0	4.58	0	ERI
132	4427		J.67372220	3.0	40.0	25.4	47.672211UU	47.0	40.0	38.0	3.10	39	D
133	4455		J.69225000	3.0	41.0	32.1	-37.420550U	-37.0	25.0	25.0	4.64	0	ERI
134	4450	RANA	J.69283330	3.0	41.0	34.2	-9.8808033U	-9.0	52.0	21.0	3.74	23	D
135	4461	ATIKS	J.70197210	3.0	42.0	7.1	32.0.78888U	32.0	10.0	44.0	3.94	38	O
136	4477	ELECTRA	J.71322220	3.0	42.0	47.6	24.0.U94733U	24.0	4.0	17.0	3.61	17	TAU
137	4474		J.71347220	3.0	42.0	48.5	42.4.67211U	42.0	28.0	11.0	3.93	41	N
138	4486	TAYGETA	J.7186666U	3.0	43.0	7.2	24.3588889U	24.0	21.0	32.0	3.37	19	TAU
139	4500	MAIA	J.72899990	3.0	43.0	44.4	24.2597211U	24.0	15.0	35.0	4.02	20	TAU
140	4517		J.72922220	3.0	43.0	45.0	-6.4.916943U	-6.4.0	55.0	1.0	3.80	0	RET
141	4512	MEROPE	J.73741660	3.0	44.0	14.0	23.810833U	23.0	50.0	27.0	4.25	23	TAU
142	4525		J.74141660	3.0	44.0	29.1	-12.2102776U	-12.0	12.0	37.0	4.64	26	P
143	4547		J.75569440	3.0	45.0	20.5	-2.3.351943U	-23.0	21.0	7.0	4.33	27	ERI
144	4541	ALCYONE	J.7566666U	3.0	45.0	24.0	23.998333U	23.0	59.0	54.0	2.96	25	H
145	4553		J.7715833U	3.0	46.0	17.0	65.4179999U	65.0	25.0	12.0	4.71	0	CAM
146	4557		J.7771944U	3.0	46.0	37.9	71.2469444U	71.0	13.0	37.0	4.67	0	CAM
147	4586	ATLAS	J.78461110	3.0	47.0	4.0	23.947778U	23.0	56.0	52.0	3.80	27	TAU
148	4633		J.796022770	3.0	47.0	45.7	-74.3666666U	-74.0	20.0	48.0	3.17	0	HY1
149	4624		J.80238880	3.0	48.0	8.0	-3.6.305277U	-36.0	18.0	19.0	4.24	0	RET
150	4688	MENKHIB	J.86544440	3.0	51.0	55.6	31.0.7811110	31.0	46.0	52.0	2.91	44	Z
151	4759		J.92497220	3.0	55.0	29.9	39.9.105550U	39.0	54.0	38.0	4.5	45	E
152	4778	ZAURAK	J.9399166U	3.0	56.0	23.7	-13.6169444U	-13.0	36.0	25.0	3.19	34	G
153	4779		J.94480550	3.0	56.0	41.0	35.6919440U	35.0	41.0	31.0	4.05	46	C
154	4808		J.9697777U	3.0	58.0	11.2	-6.1.498611UU	-61.0	29.0	25.0	4.41	0	RET
155	4801		J.97386100	3.0	58.0	25.9	-24.114444U	-24.0	6.0	52.0	4.69	36	ERI
156	4805		J.97897210	3.0	58.0	44.3	12.3927777U	12.0	23.0	34.0	3.90	35	L
157	4855		J.00641660	4.0	0	23.0	-6.2.2566660U	-6.0	15.0	24.0	4.46	0	RET
158	4862		J.021522770	4.0	1.0	17.5	5.8916111U	5.0	53.0	37.0	3.94	38	N
159	4897		J.03694440	4.0	2.0	37.3	21.987777U	21.0	59.0	16.0	4.50	37	TAU
160	4924		J.0661388U	4.0	3.0	58.1	50.2505555U	50.0	15.0	29.0	4.33	47	PER
161	4967		J.1018610U	4.0	6.0	6.0	-7.1.4179999U	-7.0	15.0	4.03	4.8	41	PER
162	5056	BELID	J.1692499U	4.0	10.0	9.3	-6.9.2749999U	-6.0	55.0	39.0	4.14	38	O
163	5099		J.2033330	4.0	12.0	19.2	4.8.322222U	4.8.0	19.0	20.0	4.26	51	M
164	5121		J.21400000	4.0	12.0	50.4	-4.2.3799999U	-42.0	22.0	48.0	3.83	40	HUR
165	5134		J.22719430	4.0	13.0	3.0	8.806111U	8.0	48.0	22.0	4.32	49	TAU
166	5138		J.22766660	4.0	13.0	39.6	-7.7.61111U	-7.0	42.0	22.0	4.48	40	ERI
167	5164		J.2383320	4.0	13.0	58.2	-6.2.56110U	-6.2.0	33.0	40.0	4.36	38	O
168	5179		J.25177770	4.0	15.0	6.0	-5.1.5714666U	-5.1.0	34.0	27.0	4.36	40	DOR
169	5174		J.26005550	4.0	15.0	5.6	50.2.11389U	50.0	12.0	41.0	4.64	0	PER
170	5194		J.26458320	4.0	15.0	52.5	-5.9.3858333U	-5.9.0	23.0	9.0	4.42	0	RET
171	5201		J.27613880	4.0	16.0	34.0	-3.3.882777U	-3.3.0	52.0	3.59	41	U	

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

172	5226	4.29663880	4.0	17.0	47.9	15.54444450	15.5	34.0	4.0.0	TAU
173	5304	4.34855550	4.0	20.0	54.0	17.46194400	17.0	27.0	4.3.0	TAU
174	5349	4.37866660	4.0	22.0	43.0	-34.0.9.22100	-34.0	25.0	4.0.6	TKI
175	5350	4.37999900	4.0	23.0	16.0	22.2.21327700	22.0	12.0	4.0.6	TKI
176	5354	4.39102780	4.0	23.0	27.7	17.84944400	17.0	50.0	4.0.6	TKI
177	5370	4.40350000	4.0	24.0	12.6	22.73583300	22.0	44.0	4.0.6	TKI
178	5375	4.40580500	4.0	24.0	20.9	15.54027770	15.0	32.0	4.0.6	TKI
179	5430 AIN	4.44283320	4.0	26.0	34.0	19.10416000	19.0	6.0	15.0	TKI
180	5433	4.44286100	4.0	26.0	34.3	15.8853320	15.0	53.0	4.0.6	TKI
181	5436	4.44433320	4.0	26.0	39.0	15.79422100	15.0	47.0	4.0.6	TKI
182	5558	4.53100000	4.0	31.0	51.0	14.7122220	14.0	46.0	4.0.6	TKI
183	5572	4.53561100	4.0	32.0	8.2	-29.83638900	-29.0	50.0	4.0.6	TKI
184	5600	4.55397210	4.0	33.0	14.3	-55.11674400	-55.0	7.0	1.0	DOK
185	5599	4.56213880	4.0	33.0	43.0	10.0.9.055500	10.0	26.0	4.0.6	TKI
186	5605 ALDEBAKAN	4.56516660	4.0	33.0	54.6	16.44027800	16.0	25.0	4.0.6	TKI LUM
187	5614 THEEMIN	4.56980550	4.0	34.0	11.3	-30.63105000	-30.0	37.0	4.0.6	ERI
188	5609	4.57097220	4.0	34.0	15.5	41.19472200	41.0	11.0	4.1.0	PEK
189	5617	4.57613890	4.0	34.0	34.0	-3.427770	-3.0	25.0	4.1.0	TKI
190	5645	4.60330550	4.0	36.0	11.9	12.44222210	12.0	22.0	4.1.0	TKI
191	5657 SCEPTRUM	4.60961100	4.0	36.0	34.6	-14.37111110	-14.0	22.0	16.0	TKI
192	5695	4.64849990	4.0	38.0	54.6	-19.735000	-19.0	44.0	4.0.6	TKI
193	5708	4.65719440	4.0	39.0	25.9	-41.92972200	-41.0	55.0	4.0.6	CAM
194	5716	4.66902770	4.0	40.0	8.5	22.89138800	22.0	53.0	4.0.6	TKI
195	5796	4.72916660	4.0	43.0	45.0	-3.3.31750000	-3.0	19.0	3.0	TKI
196	5875 TABIT	4.79897220	4.0	47.0	56.3	6.90166670	6.0	54.0	4.0.6	TKI
197	5892	4.81169400	4.0	48.0	42.1	8.84166660	8.0	50.0	4.0.6	TKI
198	5911	4.82233320	4.0	49.0	20.4	5.54666660	5.0	32.0	4.0.6	TKI
199	5924	4.84261100	4.0	50.0	33.4	66.28583200	66.0	17.0	9.0	TKI
200	5954	4.85288880	4.0	51.0	10.4	-5.5.5100000	-5.0	36.0	4.0.6	TKI
201	5978	4.8737770	4.0	52.0	25.6	2.38472200	2.0	23.0	4.0.6	TKI
202	5987	4.8827770	4.0	52.0	58.0	10.0.9.666650	10.0	5.0	4.0.6	TKI
203	6025	4.90669440	4.0	54.0	24.1	13.46055540	13.0	27.0	4.0.6	TKI
204	6017	4.91186100	4.0	54.0	28.4	53.69833100	53.0	41.0	4.0.6	TKI
205	6029 MASSALEH	4.91552770	4.0	56.0	42.7	33.11249900	33.0	6.0	45.0	TKI
206	6068	4.94552770	4.0	56.0	43.9	1.66166665	1.0	39.0	4.0.6	TKI
207	6123	4.9908880	4.0	59.0	27.2	43.77333300	43.0	46.0	24.0	AUR
208	6137 HOEDUS I	5.00047210	5.0	0	1.7	41.0.6666600	41.0	1.0	4.0.6	AUR
209	6136	5.00676110	5.0	0	17.8	60.39361100	60.0	23.0	37.0	AUR
210	6158	5.01669440	5.0	1.0	1.0	21.54166660	21.0	32.0	30.0	AUR
211	6191	5.0427770	5.0	2.0	34.0	1.356694450	15.0	21.0	25.0	AUR
212	6212	5.05244430	5.0	3.0	8.8	-35.52997900	-35.0	31.0	4.0.6	CAM
213	6231	5.06630550	5.0	3.0	58.7	-22.41694400	-22.0	25.0	4.0.6	CAM
214	6226 HOEDUS II	5.06761110	5.0	4.0	3.4	41.18888800	41.0	1.0	20.0	AUR
215	6274 URSA	5.10213880	5.0	6.0	7.7	5.13027770	-5.0	7.0	49.0	AUR
216	6304	5.12449970	5.0	7.0	28.2	-12.79449970	-8.0	47.0	51.0	TKI
217	6374	5.1772210	5.0	10.0	39.8	-11.9097220	-11.0	54.0	4.0.6	TKI
218	6382	5.1893050	5.0	11.0	21.5	-16.24823300	-16.0	14.0	4.0.6	TKI
219	6381	5.19099990	5.0	11.0	27.6	2.82033330	2.0	49.0	15.0	TKI
220	6387	5.19355540	5.0	11.0	36.8	-12.98166660	-12.0	58.0	54.0	TKI
221	6410 RIGEL	5.21424940	5.0	12.0	51.3	-8.24043330	-4.0	14.0	27.0	TKI
222	6427 CAPPELLA	5.23500000	5.0	14.0	6.0	45.96444400	45.0	52.0	4.0.6	AUR
223	6480	5.26508320	5.0	15.0	54.3	-6.88083330	-6.0	52.0	4.0.6	TKI
224	6531	5.29936110	5.0	17.0	57.7	-13.21166660	-13.0	12.0	4.0.6	TKI
225	6559	5.3158880	5.0	18.0	57.2	-21.0.27341100	-21.0	16.0	4.0.6	TKI
226	6579	5.33291660	5.0	19.0	58.5	-4.1555255	0	26.0	4.0.6	TKI
227	6646	5.37099990	5.0	22.0	15.6	-7.83888890	-7.0	54.0	20.0	TKI
228	6655	5.37861100	5.0	22.0	43.0	-2.42777770	-2.0	25.0	40.0	TKI
229	6660	5.38213880	5.0	22.0	55.7	1.81583333	1.0	48.0	4.0.6	TKI

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

230	6668	BELLATRIX	5° 38' 75.278U	15° 1	6° 31' 19.44444U	6° 0	19° 0	10° 0	24° 6
231	6681	ELNATH	5° 40' 41.305S	23° U	28° 57' 79.226U	28° 0	47° 0	11° 0	11° 2
232	6713	MATH	5° 41' 65.944U	5° 0	3° 0	3° 0	3° 0	11° 0	11° 0
233	6762	NIHAL	5° 44' 57.199U	5° 0	-20° 78.611UUU	-20° 0	47° 0	10° 0	9° 6
234	6813		5° 48.183.33U	5° 0	5° 92.27777	70°	55° 0	22° 0	3° 32°
235	6846		5° 49.994.22U	5° 0	-35° 4.952277U	-35° 0	29° 0	3° 92°	0° 0
236	6841		5° 50.266.66U	5° 0	18° 56.97222U	18° 0	34° 0	11° 0	11° 0
237	6847	MINTAKA	5° 50.361.1UU	5° 0	-3.32361.11U	-3° 0	25° 0	3° 4°	0° 0
238	6850		5° 50.394.43U	5° 0	13° 0	19° 0	19° 0	36° 0	36° 0
239	6875	ARNEB	5° 51.975.03U	5° 0	30° 0	14° 2	-7° 0	19° 0	17° 0
240	6907		5° 54.830.5U	5° 0	31° 0	-17.846.11UUU	-17° 0	50° 0	46° 0
241	6915	HEKA	5° 55.347.22U	5° 0	32° 0	53° 9	9° 46.75UUU	9° 0	3° 0
242	6944		5° 55.305.01U	5° 0	33° 0	12° 5	9° 91.22222U	9° 0	39° 0
243	6926		5° 55.555.19U	5° 0	33° 0	19° 1	-6.2.0.2525U	-6.2° 0	39° 0
244	6934		5° 56.097.22U	5° 0	33° 0	59° 3	-2.6.0.3238.889U	-6.0° 0	26° 0
245	6937	HATYSA	5° 56.199.99U	5° 0	33° 0	43° 2	-4.8.859.999.9U	-4° 0	56° 0
246	6960	AL NILAH	5° 57.394.44U	5° 0	34° 0	26° 2	-5.9.913.89U	-5° 0	55° 0
247	6972		5° 58.37.22U	5° 0	34° 0	58° 9	-1.2.2.277.777	-1° 0	22° 0
248	6985		5° 59.252.78U	5° 0	35° 0	33° 1	21° 0.22277.7U	21° 0	1.0.0
249	7031		5° 6.164.722U	5° 0	36° 0	59° 3	-2.6.1.188.88U	-2° 0	37.0
250	7042		5° 6.222.277.7U	5° 0	37° 0	20° 2	4° 0.10.30.525.5U	4° 0	56° 0
251	7078	PHAKT	5° 6.39.666.6U	5° 0	38° 0	22° 8	34.0.0.91.66.5U	34° 0	50° 0
252	7089	AL NITAK	5° 6.49.986.11U	5° 0	38° 0	59° 5	-1.9.5.97.222.1	-1° 0	57° 0
253	7197		5° 7.16.722.2U	5° 0	43° 0	.2	-2.2.4.58.61.0U	-2.2° 0	22.0
254	7246		5° 7.45.1.66.6U	5° 0	44° 0	42° 6	-4.5.7.86.1.0U	-4.5° 0	31.0
255	7247		5° 7.56.1.38.8U	5° 0	45° 0	22° 1	-1.4.8.3.88.88U	-14° 0	54.0
256	7264	SAIPH	5° 7.68.24.99U	5° 0	46° 0	5° 7	-9° 6.0.0.83.32U	-9° 0	49.0
257	7287		5° 7.74.25.00U	5° 0	46° 0	27° 3	-5.0.0.78.1.1U	-51° 0	43.0
258	7227		5° 7.79.1.38.9U	5° 0	46° 0	44° 9	39° 1.7.1.11.1U	39° 0	35.0
259	7334		5° 8.17.22.22U	5° 0	49° 0	3° 8	39° 1.9.0.227.7U	39° 0	8.0
260	7353		5° 8.19.8.33.3U	5° 0	49° 0	11° 4	-5.6° 1.74.222U	-56° 0	55.0
261	7364		5° 8.28.75.00U	5° 0	49° 0	43.5	-3.5.7.80.55.5U	-35° 0	50.0
262	7362		5° 8.30.24.99U	5° 0	49° 0	48° 9	-20° 8.0.83.33U	-20° 0	51.0
263	7389		5° 8.71.11.11U	5° 0	51° 0	7.6	27° 6.0.0.55.5U	27° 0	36.0
264	7419		5° 8.71.80.56U	5° 0	52° 0	18° 5	20° 2.7.3.88.8U	20° 0	1.6.0
265	7451	BETELGEUSE	5° 8.87.94.44U	5° 0	53° 0	16° 6	7.40.1.94.44U	7° 0	24.0
266	7477		5° 8.97.1.94.4U	5° 0	49° 9	-6.3.1.0.0.277.7U	-6.3° 0	6.0	
267	7492		5° 9.13.50.00U	5° 0	54° 0	48° 6	-1.4.1.2.277.78U	-14° 0	1.4.0
268	7536		5° 9.38.24.99U	5° 0	56° 0	17° 9	-3.5.2.86.1.1U	-35° 0	1.7.0
269	7521		5° 9.44.0.83.3U	5° 0	56° 0	38.7	54.0.28.4.16.6U	54° 0	17.0
270	7543	MENKALINAN	5° 9.49.3.33.2U	5° 0	56° 0	57° 6	44° 9.4.2.83.33U	44° 0	56.0
271	7557		5° 9.55.5.55.5U	5° 0	57° 0	20° 0	37.2.1.19.43.3U	37° 0	12.0
272	7554		5° 9.55.6.1.1UU	5° 0	57° 0	34.2	45° 9.3.5.5.5U	45° 0	56.0
273	7591		5° 9.67.8.88.8U	5° 0	58° 0	4° 4	-4.2.8.1.6.38.9U	-42° 0	48.0
274	7587		5° 9.71.7.22.2U	5° 0	58° 0	18° 2	-3.0.7.1.16.6U	-3° 0	49.0
275	7635		6.0.0.0.76.1.1U	6° 0	22.0	9° 6.0.0.88.88.9U	9° 0	38.0	
276	7675		6.0.0.30.6.6.7U	6° 0	1.0	50° 4	20° 1.4.0.8.3.3U	20° 0	8.0
277	7676		6.0.0.33.1.9.4U	6° 0	1.0	59.5	23° 2.6.0.9.4.4U	23° 0	1.0
278	7742		6.0.0.76.1.6.6U	6° 0	4° 0	-1.4.9.3.0.8.3.3U	-14° 0	55.0	
279	7772		6.0.0.9.2.8.8.8U	6° 0	5.0	34.4	1.4.2.7.7.4.1.6.6U	14° 0	46.0
280	7889		6.0.1.6.5.8.3.3U	6° 0	9.0	57° 0	1.4.2.1.8.1.3.3.2U	14° 0	1.0
281	7969	TEJAT PRIOR	6.0.2.1.2.7.4.9U	6° 0	12.0	45.9	22.5.1.8.6.1.1U	22° 0	31.0
282	7981		6.0.2.1.9.1.3.8U	6° 0	13.0	8.9	29° 5.1.2.7.7.7U	29° 0	1.0
283	7986		6.0.2.9.1.3.8U	6° 0	13.0	59.9	-6.2.6.2.7.7.7U	-6° 0	15.0
284	8020		6.0.2.9.8.8.8U	6° 0	14.0	59.6	6.9.3.3.5.2.7U	69° 0	20.0
285	8062		6.0.2.5.5.0.8.3U	6° 0	15.0	18.3	-3.5.1.2.8.0.5.5U	-35° 0	7.0
286	8068		6.0.2.7.5.6.1.1U	6° 0	16.0	32.2	59° 0.0.2.6.1.1U	59° 0	1.0
287	8170	FUKUD	6.0.3.1.6.1.3.8U	6° 0	18.0	58.0	-3.0.0.4.6.6.6.6U	-30° 0	2.0

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

288	8214		6*34722220	6.0	20.0	50.0	-33.417771.00	-33.0	4.0	25.0	4.0	J.98	3 D	
289	8208	TEJAT POSTERIOR	6*34738880	6.0	20.0	50.6	22.533333.00	22.0	1.9	1.9	1.9	J.98	13 M	
290	8223	MIRZAH	6*35263880	6.0	21.0	9.5	-17.937221.00	-17.0	5.6	5.6	5.6	J.99	2 S	
291	8240		6*36522220	6.0	21.0	54.8	4*61194440	4.0	36.0	36.0	36.0	J.98	8 E	
292	8302	CANOPUS	SUHEL	6*38625000	6.0	22.0	10.5	-52.676111.00	-52.0	40.0	40.0	40.0	J.98	CAR
293	8410		6*44783320	6.0	26.0	52.2	-32.55694400	-32.0	33.0	33.0	33.0	J.98	CMA	
294	8394		6*44808320	6.0	26.0	53.1	20.235833.00	20.0	1.4	1.4	1.4	J.98	18 N	
295	8413		6*45197220	6.0	27.0	7.1	-7.00916660	-7.0	0.0	0.0	0.0	J.98	MUN	
296	8496		6*0661100	6.0	30.0	23.8	-23.0	-23.0	2.4	2.4	2.4	J.98	CMA	
297	8506		6*5166110	6.0	31.0	0.7	7.35499990	7.0	21.0	21.0	21.0	J.98	MON	
298	8577		6*5980540	6.0	33.0	35.3	-22.935833.00	-22.0	5.6	5.6	5.6	J.98	C	
299	8604		6*57005560	6.0	34.0	12.2	-52.94636800	-52.0	56.0	56.0	56.0	J.98	CAR	
300	8624	MEBSUTA		6*5894440	6.0	35.0	9.4	-19.225400	-19.0	1.0	1.0	1.0	J.98	7 N
301	8633	ALHENIA		6*59483330	6.0	35.0	41.4	1.6*43055500	1.6	25.0	25.0	25.0	J.98	6 E
302	8660		6*60583330	6.0	36.0	21.0	-18.20583300	-18.0	12.0	12.0	12.0	J.98	CMA	
303	8675		6*61149990	6.0	36.0	41.4	-43.16444400	-43.0	9.0	9.0	9.0	J.98	PUP	
304	8720		6*65083330	6.0	39.0	3.0	9.929722.00	9.0	55.0	55.0	55.0	J.98	U N	
305	8786		6*69633320	6.0	41.0	46.8	25.16749200	25.0	10.0	10.0	10.0	J.98	27 E	
306	8793		6*70025000	6.0	42.0	9	1.3*2647210	1.3	0.0	0.0	0.0	J.98	GEN	
307	8823		6*72208320	6.0	43.0	19.5	1.2*93472220	1.2	0.0	0.0	0.0	J.98	31 C	
308	8833	SIRIUS	CANICULA	6*72677770	6.0	43.0	36.4	-16.0	-16.0	40.0	40.0	-	J.98	CMA
309	8892		6*76724990	6.0	46.0	2.1	2.45194440	2.0	27.0	27.0	27.0	J.98	MON	
310	8941		6*79722120	6.0	47.0	50.0	-6.1*90364000	-6.0	54.0	54.0	54.0	J.98	PIC	
311	8946		6*80888880	6.0	48.0	32.0	-32.46699400	-32.0	28.0	28.0	28.0	J.98	CMA	
312	8969		6*81777780	6.0	49.0	4.0	50.0	-50.0	34.0	20.0	20.0	J.98	PUP	
313	8972		6*81925000	6.0	49.0	5.7	-53.58083300	-53.0	34.0	34.0	34.0	J.98	CAR	
314	8989		6*84138880	6.0	50.0	29.0	-34.0	-34.0	0.0	19.0	19.0	J.98	GEN	
315	9034		6*866724980	6.0	52.0	2.1	-20.17972200	-20.0	10.0	10.0	10.0	J.98	15 CMA	
316	9051		6*87605540	6.0	52.0	33.8	-11.99361120	-11.0	59.0	59.0	59.0	J.98	14 J	
317	9049		6*876783320	6.0	52.0	40.2	1.3*22361100	1.3	0.0	1.0	1.0	J.98	38 GEN	
318	9059		6*87797210	6.0	52.0	40.7	-24.13916600	-24.0	8.0	21.0	21.0	J.98	CMA	
319	9096		6*90175000	6.0	54.0	6.3	-20.09055500	-20.0	54.0	54.0	54.0	J.98	18 P	
320	9082		6*90419440	6.0	54.0	15.1	58.47013300	58.0	28.0	28.0	28.0	J.98	4.66	
321	9107		6*90958330	6.0	54.0	34.0	-17.007500	-17.0	0.0	0.0	0.0	J.98	20 I	
322	9073		6*91652770	6.0	54.0	59.5	7.0*02513300	7.0	1.0	3.0	3.0	J.98	CAM	
323	9188	ADHARA	AUARA	6*95416670	6.0	57.0	15.0	-28.92331300	-28.0	55.0	24.0	24.0	J.98	21 E
324	9276		7.00541660	7.0	0	19.5	-22.88361100	-22.0	53.0	53.0	53.0	J.98	CMA	
325	9307		7.02605550	7.0	1.0	33.8	-23.7811100	-23.0	46.0	46.0	46.0	J.98	24 O	
326	9313	MEKBUDA		7.03388880	7.0	2.0	2.0	20.62233300	20.0	37.0	37.0	37.0	J.98	43 Z
327	9320	MULIPHEIN		7.03624990	7.0	2.0	10.5	-15.58027770	-15.0	34.0	34.0	34.0	J.98	23 G
328	9443	WEZEN		7.11613880	7.0	6.0	58.1	-22.8*92336600	-22.0	20.0	20.0	20.0	J.98	25 D
329	9484		7.14855550	7.0	8.0	54.8	30.30416600	30.0	1.0	1.0	1.0	J.98	CMA	
330	9514		7.15086110	7.0	9.0	3.1	-70.44222100	-70.0	26.0	26.0	26.0	J.98	VOL	
331	9518		7.16794440	7.0	10.0	4.6	-43333333.0	-4.0	26.0	26.0	26.0	J.98	O	
332	9569		7.19269440	7.0	11.0	33.7	-46.69999400	-46.0	42.0	42.0	42.0	J.98	PUP	
333	9604		7.20737530	7.0	12.0	28.2	-44.58194400	-44.0	34.0	34.0	34.0	J.98	PUP	
334	9608		7.21375000	7.0	12.0	49.5	-26.2911100	-26.0	17.0	17.0	17.0	J.98	CMA	
335	9625		7.22316660	7.0	13.0	23.4	-26.71081100	-26.0	42.0	42.0	42.0	J.98	CMA	
336	9706		7.26511110	7.0	15.0	54.4	-37.033333.0	-37.0	2.0	2.0	2.0	J.98	PUP	
337	9701		7.26805550	7.0	16.0	5.0	-16.60499900	-16.0	36.0	36.0	36.0	J.98	GEN	
338	9747		7.28088890	7.0	16.0	51.2	-6.7*89333200	-6.7	53.0	53.0	53.0	J.98	VOL	
339	9733		7.28436100	7.0	17.0	3.7	-3.6.66916600	-3.6	40.0	40.0	40.0	J.98	PUP	
340	9736		7.28761110	7.0	17.0	15.4	-24.88944400	-24.0	53.0	53.0	53.0	J.98	CMA	
341	9755	ASAT		7.30058330	7.0	18.0	2.1	-22.04033300	-22.0	2.0	2.0	2.0	J.98	55 D
342	9886	ALUDRA		7.37850000	7.0	22.0	42.0	-29.23338890	-29.0	14.0	14.0	14.0	J.98	31 H
343	9897		7.39258330	7.0	23.0	33.3	-27.86916600	-27.0	52.0	52.0	52.0	J.98	40 I	
344	9909		7.40130550	7.0	24.0	4.7	49*28305500	49.0	16.0	16.0	16.0	J.98	21 LYN	
345	9947	GOMEISA		7.42088880	7.0	25.0	15.2	8.36111110	8.0	40.0	40.0	40.0	J.98	3 C

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

346	9974	7.0	26.0	15.5	8.997777770	8.0	52.0	59.0	4.6
347	9987	7.0	26.0	51.8	31.855555500	31.0	51.0	20.0	4.18
348	10040	7.0	28.0	7.2	-4.3.22972100	-43.0	13.0	47.0	3.27
349	10120	7.0	32.0	22.1	31.966338800	31.0	57.0	59.0	1.58
350	10134	7.0	32.0	32.0	-2.2.21944400	-22.0	13.0	10.0	4.52
351	10167	7.0	33.0	46.1	26.97500000	26.0	58.0	30.0	4.22
352	10178	7.0	33.0	56.5	-2.8.29111100	-28.0	17.0	28.0	4.55
353	10246	7.0	36.0	4.3	-1.4.888888400	-34.0	53.0	20.0	4.62
354	10266	7.0	36.0	50.4	-2.5.48444400	-25.0	17.0	4.0	4.64
355	10281	7.0	37.0	23.2	-2.6.72111100	-26.0	43.0	16.0	4.50
356	10277	7.0	37.0	28.2	5.31583330	5.0	18.0	57.0	4.48
357	10345	7.0	39.0	34.5	-9.46833330	-9.0	28.0	6.0	4.07
358	10375	7.0	41.0	7.6	-2.8.96972100	-28.0	58.0	11.0	4.26
359	10444	7.0	42.0	15.8	-2.2.52249900	-72.0	31.0	21.0	75.5
360	10403	7.0	42.0	20.2	24.483333400	24.0	29.0	0	2
361	10417	7.0	42.0	24.1	-28.87027700	-28.0	52.0	13.0	4.10
362	10438	7.0	43.0	10.6	28.11222200	28.0	6.0	44.0	1.21
363	10462	7.0	44.0	9.4	-37.88277700	-37.0	52.0	58.0	78.0
364	10532	7.0	46.0	3.7	-25.84917400	-25.0	50.0	3.72	0
365	10553	7.0	47.0	17.7	-46.98841000	-46.0	59.0	4.59	0
366	10562	7.0	47.0	49.0	-24.7707083300	-24.0	46.0	19.0	4.64
367	10576	7.0	48.0	10.3	-4.6.28444400	-44.0	17.0	4.0	4.25
368	10655	7.0	51.0	8.8	-40.48472200	-40.0	29.0	5.0	3.74
369	10661	7.0	51.0	24.3	-38.77133680	-38.0	46.0	17.0	4.53
370	10689	7.0	52.0	16.4	-48.01111100	-48.0	40.0	4.32	0
371	10754	7.0	52.0	21.2	-22.78555500	-22.0	47.0	8.0	4.35
372	10770	7.0	55.0	53.3	-52.88777700	-52.0	53.0	15.0	3.47
373	10802	7.0	57.0	14.0	-49.14916600	-49.0	6.0	17.0	7.0
374	10825	7.0	58.0	17.9	-18.0	-18.0	18.0	5.0	4.00
375	10891	8.0	8.0	26.7	2.43194400	2.0	25.0	55.0	2.32
376	10947	8.0	2.0	21.2	-39.90361000	-39.0	54.0	13.0	2.27
377	11034	8.0	6.0	3.2	-24.20250000	-24.0	12.0	9.0	2.68
378	11051	8.0	6.0	50.1	-2.8805550	-2.0	52.0	50.0	4.41
379	11071	8.0	7.0	27.8	-19.14136800	-19.0	8.0	29.0	4.34
380	11098	8.0	7.0	49.5	-6.51414500	-48.0	30.0	51.0	4.46
381	11105	8.0	8.0	37.1	9.29472220	9.0	17.0	41.0	3.76
382	11134	8.0	17.0	14.7	-47.723277800	-47.0	13.0	58.0	1.90
383	11149	8.0	19.0	37.8	-12.8219440	-12.0	49.0	19.0	4.68
384	11215	8.0	10.0	6.4	-39.51333300	-39.0	30.0	48.0	4.43
385	11254	8.0	12.0	48.3	-40.24027700	-40.0	14.0	25.0	4.43
386	11343	8.0	17.0	54.7	-3.79111100	-3.0	47.0	26.0	1.78
387	11419	8.0	25.0	21.8	-6.6.0192100	-6.0	1.0	11.0	3.95
388	11401	8.0	27.0	22.3	60.83694400	60.0	50.0	13.0	3.47
389	11481	8.0	35.0	48.3	-5.82644400	-5.0	49.0	7.0	4.43
390	11463	8.0	36.0	4.7	-42.86611100	-42.0	51.0	58.0	4.26
391	11499	8.0	36.0	55.7	-3.46527780	-3.0	23.0	1.74	0
392	11567	8.0	38.0	43.9	-3.351830500	-35.0	10.0	55.0	5.5
393	11593	8.0	39.0	17.4	-5.2.7922200	-52.0	47.0	50.0	3.68
394	11623	8.0	39.0	27.8	-4.6.5231100	-46.0	31.0	25.0	5.3
395	11652	8.0	39.0	50.7	-5.9.63583300	-59.0	38.0	9.0	4.42
396	11686	8.0	41.0	15.8	21.59555600	21.0	35.0	44.0	4.73
397	11923	8.0	23.0	41.0	3.55527770	3.0	31.0	31.0	4.32
398	11943	8.0	57.3	41.0	-7.104666660	-7.0	47.0	47.0	3.71
399	11951	8.0	6.0	8.0	-6.6.99244900	-6.0	4.0	4.0	4.0
400	11964	8.0	6.0	8.0	-6.6.6408330	-6.0	4.0	4.0	4.0
401	11982	8.0	6.0	8.0	-6.6.8772210	-6.0	4.0	4.0	4.0
402	11987	8.0	6.0	8.0	-6.88994400	-6.0	4.0	4.0	4.0
403	12006	8.0	6.0	8.0	-6.6.99244900	-6.0	4.0	4.0	4.0

404	12018		8.0	42.0	1.1	1	PYX	3.70	0	A
405	12022	ASELLUS-AUSTR.	8.0	42.0	41.9	18.0	CNC	4.17	47	D
406	12050		8.0	43.0	8.9	-42.0	VEL	4.12	0	O
407	12069		8.0	43.0	4.2	-54.0	CNC	2.01	0	O
408	12083		8.0	44.0	35.0	-28.0	4.20	46	I	
409	12097		8.0	44.0	43.3	-13.0	HYA	4.44	12	I
410	12109		8.0	44.0	50.4	-45.0	VEL	4.09	0	O
411	12102		8.0	44.0	55.4	6.0	CAR	3.48	11	E
412	12138		8.0	45.0	48.3	-56.0	CAR	4.63	0	R
413	12148		8.0	46.0	34.8	5.0	HYA	4.02	13	R
414	12216		8.0	49.0	2.8	-27.0	PYX	4.19	0	G
415	12327		8.0	53.0	32.7	-57.0	HYA	3.30	16	Z
416	12359		8.0	54.0	15.4	-60.0	CAR	3.08	0	O
417	12406	ACUBENS	8.0	56.0	34.5	11.0	CNC	4.27	*5	A
418	12407	TALITHA	8.0	56.0	49.2	48.0	UMA	3.12	9	I
419	12434		8.0	56.0	22.5	41.0	UMA	4.09	10	U
420	12451		8.0	58.0	46.9	-41.0	VEL	4.42	91	K
421	12503		9.0	58.0	1.0	14.0	HYA	4.64	12	K
422	12532		9.0	59.0	1.0	53.9	VOL	4.04	0	A
423	12545		9.0	59.0	2.0	56.7	VEL	3.69	0	T
424	12565		9.0	59.0	4.0	1.8	LYN	4.71	0	CAR
425	12595		9.0	59.0	4.3	-72.0	HYA	4.50	0	O
426	12604		9.0	60.0	24.8	51.0	UMA	4.54	15	U
427	12623	SUHAIL	9.0	60.0	42.4	-43.0	VEL	2.22	0	L
428	12646		9.0	60.0	3.2	6.3	UMA	4.74	14	T
429	12696		9.0	60.0	2.7	-58.0	CAR	4.56	0	O
430	12707		9.0	60.0	29.1	-62.0	CAR	4.18	0	CAR
431	12743	MIAPLACIUS	9.0	62.0	32.7	-27.0	HYA	3.84	22	J
432	12764		9.0	62.0	49.5	-69.0	CAR	4.00	0	S
433	12787		9.0	64.0	21.0	-37.0	VEL	4.70	0	O
434	12813		9.0	65.0	12.9	-57.0	CAR	4.18	0	CAR
435	12831	TUREIS	9.0	66.0	9.0	-59.0	LYN	2.25	0	I
436	12830		9.0	66.0	40.3	-36.0	UMA	3.82	38	ANT
437	12880		9.0	68.0	55.7	34.0	VEL	3.30	40	A
438	12938		9.0	69.0	21.0	1.7	UMA	2.63	0	K
439	12972		9.0	69.0	22.0	37.0	LEO	4.61	1	L
440	13044	ALPHARD COR- HYDRAE	9.0	69.0	25.0	52.0	VEL	2.16	30	A
441	13091		9.0	69.0	27.0	47.9	HYA	4.64	0	E
442	13109		9.0	69.0	28.0	47.4	UMA	3.75	23	U
443	13140		9.0	69.0	29.0	19.2	VEL	3.64	0	Y
444	13143		9.0	69.0	31.0	23.6	UMA	4.57	24	LEO
445	13160		9.0	69.0	32.0	9.4	UMA	4.62	10	LMI
446	13153		9.0	69.0	30.0	11.9	VEL	4.50	1	DRA
447	13157		9.0	69.0	32.0	47.9	HYA	4.65	26	UMA
448	13192		9.0	69.0	31.0	21.9	CAR	3.26	0	CAR
449	13171		9.0	69.0	31.0	25.0	VEL	4.00	0	VEL
450	13203		9.0	69.0	32.0	5.1	HYA	3.55	1	CAR
451	13174		9.0	69.0	32.0	14.7	UMA	4.67	0	CAR
452	13212		9.0	69.0	32.0	26.2	UMA	3.76	14	LEO
453	13246		9.0	69.0	33.0	25.0	VEL	4.74	0	HYA
454	13293		9.0	69.0	33.0	34.4	UMA	4.00	17	E
455	13341		9.0	69.0	34.0	4.1	UMA	4.00	0	CAR
456	13355		9.0	69.0	34.0	22.8	HYA	4.67	0	CAR
457	13366	SUBRA	9.0	69.0	34.0	17.0	UMA	4.00	0	LEO
458	13373		9.0	69.0	34.0	41.1	UMA	4.74	0	HYA
459	13443	RAS-ELASED AUSTR.	9.0	69.0	34.0	23.0	VEL	3.12	17	E
460	13462		9.0	69.0	34.0	17.1	UMA	4.00	0	CAR
461	13506		9.0	69.0	34.0	13.7	UMA	3.08	0	CAR

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

520	15567	11.0	29313870	17.0	35.0	-14.0	20.0	3.82
521	15600	11.0	32219430	19.0	6.0	-22138890	13.0	4.13
522	15601	11.0	32238880	19.0	6.0	-2916600	17.0	7.7
523	15652	11.0	36836100	24.2	5.0	-54.0	17.0	4.26
524	15669	11.0	38850000	6.1	10.0	-72222220	20.0	4.03
525	15799	11.0	GIANFAR	23.0	7.8	-17.0	29.0	4.03
526	15845	11.0	48911040	29.0	20.8	-17.0	28.0	4.06
527	15899	11.0	52127770	31.0	16.6	-31.0	31.0	1.1
528	15927	11.0	5630540	34.0	9.5	-62.0	50.0	DRA
529	16131	11.0	58594430	35.0	9.4	-63.0	50.0	CEN
530	16135	11.0	73238870	43.0	56.4	-66.0	50.0	LEO
531	16137	11.0	734680540	44.0	3.6	-67.0	43.0	15.6
532	16147	11.0	74683320	44.0	12.5	-69.0	39.0	HYA
533	16173	11.0	76969440	46.0	10.9	-71.0	34.0	CEN
534	16176	11.0	77571990	46.0	32.0	-72.0	34.0	LEO
535	16189	11.0	DENEBOA	47.0	16.5	-75.5	32.0	1.1
536	16201	11.0	ZAVIJAH	47.0	58.2	-63.0	32.0	MUS
537	16215	11.0	81452770	48.0	52.3	-97.3	32.0	VIR
538	16226	11.0	82311090	49.0	23.2	-1.0	24.0	6.3
539	16558	11.0	85224480	51.0	8.1	-60.0	24.0	CEN
540	16268	11.0	PHEKDAII	51.0	59.8	-97.3	24.0	LEO
541	16225	11.0	94813870	59.0	4.7	-63.0	24.0	CEN
542	16463	11.0	02052770	61.0	13.9	-1.0	24.0	1.1
543	16512	12.0	05711100	12.0	3.0	-25.6	53.0	MUS
544	16551	12.0	08402770	12.0	5.0	-8.0	53.0	VIR
545	16584	12.0	10891650	12.0	6.0	-32.1	53.0	LEO
546	16586	12.0	11005560	12.0	6.0	-36.2	53.0	CEN
547	16618	12.0	13869410	12.0	8.0	-19.3	53.0	CRY
548	16651	12.0	16355550	12.0	9.0	-25.6	53.0	CEN
549	16724	12.0	22124980	12.0	13.0	-16.5	53.0	CRU
550	16736	12.0	22936110	12.0	13.0	-50.0	53.0	CRU
551	16740	12.0	23338860	12.0	14.0	-32.1	53.0	1.1
552	16764	12.0	26105510	12.0	15.0	-22.0	53.0	2.5
553	16775	12.0	27094440	12.0	16.0	-8.0	53.0	CEN
554	16785	12.0	27541640	12.0	16.0	-44.0	53.0	CRU
555	16813	12.0	30188880	12.0	18.0	-64.0	53.0	CRU
556	16849	12.0	32430550	12.0	19.0	-2.0	53.0	1.1
557	16953	12.0	41061110	12.0	24.0	-17.0	53.0	MUS
558	16964	12.0	41991650	12.0	25.0	-67.0	53.0	CHI
559	16999	12.0	43563880	12.0	26.0	-79.0	53.0	CEN
560	17029	12.0	46749980	12.0	28.0	-61.0	53.0	2.5
561	17052	12.0	50438870	12.0	29.0	-47.5	53.0	VIR
562	17087	12.0	50588860	12.0	30.0	-60.0	53.0	CRU
563	17086	12.0	59630530	12.0	30.0	-62.0	53.0	MUS
564	17126	12.0	65961100	12.0	31.0	-59.9	53.0	CEN
565	17127	12.0	66474990	12.0	32.0	-50.0	53.0	CRU
566	17133	12.0	KRAZ	32.0	5.0	-1.0	53.0	9.5
567	17179	12.0	58461090	32.0	32.0	-45.4	53.0	MUS
568	17194	12.0	59630530	32.0	35.0	-54.0	53.0	CEN
569	17262	12.0	65961100	32.0	35.0	-48.0	53.0	SK
570	17270	12.0	66474990	32.0	39.0	-1.0	53.0	VIR
571	17282	12.0	67738880	32.0	40.0	-16.0	53.0	CEN
572	17339	12.0	72597210	32.0	43.0	-56.0	53.0	CRU
573	17348	12.0	73524980	32.0	44.0	-67.0	53.0	MUS
574	17374	12.0	76102750	32.0	45.0	-59.0	53.0	CRU
575	17473	12.0	85205540	32.0	51.0	-48.0	53.0	CEN
576	17489	12.0	85816640	32.0	51.0	-39.0	53.0	CEN
577	17518	12.0	87491650	32.0	52.0	-56.0	53.0	UMA

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

636	19548	14+45961090	14+0	27+0	34+6	75+85138800	75+0	51+0	4+37	
637	19590	14+50408310	14+0	30+0	14+7	+50+30305500	-50+0	11+0	0+0	
638	19597	14+50536100	14+0	30+0	19+3	30+52416600	30+0	16+0	0+0	
639	19607	14+51113860	14+0	30+0	40+1	38+46055500	38+0	27+0	25+0	
640	19659	14+55258320	14+0	33+0	9+3	29+89638800	29+0	53+0	27+0	
641	19656	14+55458310	14+0	33+0	16+5	-42+00550000	-42+0	18+0	4+05	
642	19698	14+59199990	14+0	35+0	31+2	-49+27444400	-49+0	16+0	4+14	
643	19728	RIGIL KENTAUROS	14+0	37+0	12+5	-60+69222200	-60+0	32+0	0+0	
644	19777	14+65791660	14+0	39+0	28+5	13+87750090	13+0	52+0	0+0	
645	19774	14+69986100	14+0	39+0	35+5	-23+146600	-47+0	14+0	2+0	
646	19772	14+66091660	14+0	39+0	39+3	-64+82416600	-64+0	49+0	2+0	
647	19779	14+66397210	14+0	39+0	46+7	-37+64444400	-37+0	38+0	4+09	
648	19816	14+686896100	14+0	41+0	12+7	-55+50722220	-55+0	30+0	107+0	
649	19820	14+697241660	14+0	41+0	30+5	-35+02416600	-35+0	1+0	27+0	
650	19834	14+72374990	14+0	43+0	25+5	-78+89833200	-78+0	53+0	5+0	
651	19856	IZAR PULCHERRIMA	14+0	43+0	27+5	27+22083300	27+0	13+0	15+0	
652	19858	14+72677770	14+0	43+0	36+4	17+11138900	17+0	6+0	41+0	
653	19884	14+74127750	14+0	44+0	28+6	2+03914660	2+0	2+0	3+76	
654	19954	14+80377760	14+0	48+0	13+6	-27+81583300	-27+0	48+0	109+0	
655	19975	ZUBEN ELGENUBI	14+0	48+0	56+3	-15+89749990	-15+0	51+0	3+76	
656	19977	14+81563800	14+0	49+0	20+7	-43+43166600	-43+0	27+0	2+0	
657	19991	14+82957760	14+0	49+0	46+3	-19+24527700	-19+0	43+0	4+69	
658	20029	KOCHAB	14+0	50+0	47+2	7+429861100	74+0	17+0	3+76	
659	20115	14+92252770	14+0	55+0	21+1	-4+20500000	-4+0	12+0	18+0	
660	20128	14+93216660	14+0	56+0	13+8	-42+99444400	-42+0	59+0	40+0	
661	20146	NEKKARI	14+94791660	14+0	56+0	-41+9650000	-41+0	57+0	2+90	
662	20226	MEREZ	14+82244660	14+0	56+0	52+5	-40+52749990	-40+0	54+0	2+0
663	20237	15+01683330	15+0	0+0	37+6	-2+22749990	-2+0	13+0	43+0	
664	20253	15+03361110	15+0	1+0	47+2	-25+14583300	-25+0	6+0	2+24	
665	20271	15+04541670	15+0	2+0	43+5	-46+91555500	-46+0	54+0	16+0	
666	20285	15+049040520	15+0	2+0	56+7	27+08305500	-27+0	4+0	2+0	
667	20356	15+10791640	15+0	6+0	28+5	-45+14666600	-45+0	6+0	4+49	
668	20409	15+15816640	15+0	9+0	29+4	-48+60638800	-48+0	13+0	3+76	
669	20418	15+16223630	15+0	9+0	45+5	-51+6749990	-51+0	58+0	3+76	
670	20433	15+17036110	15+0	10+0	13+3	-19+46605550	-19+0	39+0	38+0	
671	20523	15+23498330	15+0	14+0	5+4	-33+91444400	-33+0	26+0	40+0	
672	20507	15+24594410	15+0	14+0	45+4	-58+67222200	-58+0	40+0	20+0	
673	20519	ZUBEN ELSCHEMALI	15+25199980	15+0	15+0	-9+5550000	-9+0	15+0	18+0	
674	20538	15+26024980	15+0	15+0	36+9	-6+8855222100	-6+0	33+0	8+0	
675	20550	15+26158320	15+0	15+0	41+7	-30+02138800	-30+0	1+0	17+0	
676	20554	15+26811090	15+0	16+0	5+2	-47+74777700	-47+0	44+0	52+0	
677	20620	15+31788870	15+0	19+0	4+4	-40+5222100	-40+0	31+0	20+0	
678	20643	15+32630530	15+0	19+0	34+7	-36+013583300	-36+0	8+0	3+76	
679	20659	15+338424980	15+0	20+0	17+7	-44+56499900	-44+0	33+0	54+0	
680	20663	15+34288870	15+0	20+0	34+4	-59+19818990	-59+0	11+0	47+0	
681	20692	PHERKAD	15+34613880	15+0	20+0	23+1	-29+22527700	-29+0	13+0	3+76
682	20708	15+34852770	15+0	20+0	54+7	-36+73144400	-36+0	57+0	31+0	
683	20714	15+38430540	15+0	23+0	3+5	-38+6111000	-38+0	34+0	4+36	
684	20724	ALKALUROPS	15+38611100	15+0	23+0	10+0	-37+49888800	-37+0	29+0	56+0
685	20747	15+40222210	15+0	24+0	8+0	-59+08805500	-59+0	17+0	3+76	
686	20795	NUSAKAN	15+43974980	15+0	26+0	-59+19561000	-59+0	57+0	4+43	
687	20908	15+52527770	15+0	31+0	31+0	-31+47611000	-31+0	28+0	34+0	
688	20926	15+54666670	15+0	32+0	48+0	-41+05055500	-41+0	3+0	2+95	
689	20942	GNOIAS	15+55213880	15+0	33+0	-10+65722200	-10+0	39+0	0+0	
690	20947	ALPHECCA	15+55341660	15+0	33+0	26+83138800	26+0	49+0	53+0	
691	20932	15+55822210	15+0	33+0	29+6	-66+20164500	-66+0	12+0	4+11	
692	20949	ZUBEN ELAKRAB	15+55941660	15+0	33+0	-14+67446660	-14+0	40+0	27+0	
693	20979	ZUBEN ELAKRAB	15+58155550	15+0	34+0	-28+02055500	-28+0	1+0	37+0	

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

494	21001	15.59480530	35.0	41.3	-42+453088800	-42.0	27.0	14.0	4.27		
495	21019	15.60833320	15.0	36.0	30.0	-79+66416600	-29.0	51.0	0 W		
496	21042	15.62561090	15.0	37.0	32.2	-34+29888900	-34.0	56.0	LUP		
497	21070	15.64922210	15.0	38.0	46.4	-44+54694400	-44.0	49.0	LUP		
498	21102	15.66617220	15.0	39.0	59.0	19+78194400	19.0	46.0	LUP		
499	21130	15.68786100	15.0	41.0	16.3	26+40527700	26.0	24.0	LUP		
500	21158	COR SERPENTIS UNUKI	15.7022760	15.0	42.0	32.5	6+53444440	6.0	32.0	SER ELMAIA	
501	21194	15.7421320	15.0	44.0	34.2	15+53000000	15.0	31.0	SER		
502	21201	15.7456430	15.0	44.0	44.5	7+46146460	7.0	27.0	LUP		
503	21243	15.75447200	15.0	45.0	16.1	77+90305500	77.0	54.0	21.1	SER	
504	21255	15.7845550	15.0	47.0	9.8	16+24833300	16.0	14.0	16.0	SER	
505	21269	15.79450000	15.0	47.0	47.4	-3+32444440	-3.0	19.0	28.0	SER	
506	21276	15.8020330	15.0	48.0	7.5	26+17416500	26.0	10.0	10.0	CRB	
507	21281	15.8121380	15.0	48.0	43.7	-33+52222100	-33.0	21.0	20.0	LUP	
508	21288	15.8170540	15.0	49.0	4.1	4+58166670	4.0	34.0	34.0	LUP	
509	21340	15.85772200	15.0	51.0	27.8	-42+54861000	-42.0	32.0	55.0	14.0	
510	21329	15.85841460	15.0	51.0	30.3	-25+24146400	-25.0	13.0	27.0	SCD	
511	21342	15.86380540	15.0	51.0	49.7	-16+62905500	-16.0	37.0	41.0	LUP	
512	21332	15.86733310	15.0	52.0	2.9	-6+32472100	-6.0	19.0	29.0	TRA	
513	21398	15.91197220	15.0	54.0	43.1	-29+11333300	-29.0	6.0	5.0	SCD	
514	21408	15.9139450	15.0	54.0	50.1	15+7744430	15.0	46.0	30.0	SER	
515	21440	15.93561100	15.0	56.0	8.2	26+97805500	26.0	58.0	4.22	CRB	
516	21439	15.9370820	15.0	56.0	13.5	-14+18000000	-14.0	10.0	10.0	SCD	
517	21447	15.9454990	15.0	56.0	43.8	-26+01472100	-26.0	0.0	53.0	LUP	
518	21476	15.9623500	15.0	57.0	47.7	-38+0243300	-38.0	17.0	54.0	SCD	
519	21469	15.9709790	15.0	58.0	15.6	-22+52361100	-22.0	31.0	25.0	NOR	
520	21539	DSCHUBBA	16.01052700	16.0	54.0	50.1	15+7744430	15.0	46.0	28.0	SCD
521	21572	16.02050300	16.0	56.0	8.2	-49+13388900	-49.0	8.0	2.0	13.0	
522	21580	16.02844400	16.0	56.0	1.0	58+05805500	58.0	39.0	29.0	SCD	
523	21583	16.04066600	16.0	56.0	42.4	4+613305500	44.0	7.0	41.0	SCD	
524	21609	ACRAB	16.05663800	16.0	59.0	2.0	-11+27805560	-11.0	16.0	41.0	SCD
525	21625	16.07147200	16.0	59.0	23.9	-19+7111100	-19.0	42.0	40.0	SCD	
526	21639	16.07924700	16.0	59.0	4.0	-34+70841100	-34.0	42.0	31.0	SCD	
527	21659	16.08913800	16.0	59.0	45.0	-20+57563300	-20.0	34.0	33.0	SCD	
528	21736	16.12775000	16.0	7.0	20.9	-20+7555500	-20.0	46.0	32.0	SCD	
529	21773	LESATH	16.16594300	16.0	9.0	39.9	-45+02555500	-45.0	1.0	32.0	SCD
530	21778	16.1692700	16.0	10.0	6.5	-19+31111000	-19.0	22.0	16.0	SCD	
531	21819	16.20391600	16.0	12.0	17.3	-27+8372200	-27.0	50.0	47.0	SCD	
532	21838	YED PRIOR	16.20847100	16.0	12.0	4.0	-63+59861000	-63.0	35.0	55.0	SCD
533	21920	YED POSTERIOR	16.27444400	16.0	16.0	5.0	-30+5555500	-30.0	36.0	20.0	SCD
534	21933	16.28686000	16.0	17.0	28.0	-4+0861100	-4.0	36.0	31.0	SCD	
535	21957	16.31144400	16.0	18.0	12.7	-50+07166400	-50.0	4.0	18.0	SCD	
536	21982	16.317461000	16.0	19.0	1.0	-27+8372200	-27.0	50.0	47.0	SCD	
537	22012	16.33958300	16.0	20.0	22.5	-19+23416600	-19.0	24.0	20.0	SCD	
538	22020	16.34552700	16.0	20.0	43.9	-30+9722100	-30.0	58.0	20.0	SCD	
539	22042	16.36752700	16.0	22.0	3.1	-19+5694400	-19.0	57.0	25.0	SCD	
540	22101	16.39186100	16.0	23.0	30.7	6+59305500	6.0	35.0	2.0	SCD	
541	22090	KAJAH	16.39463000	16.0	23.0	47.9	14+1250000	14.0	45.0	4.53	
542	22134	16.4317700	16.0	25.0	54.4	-8+2950000	-8.0	17.0	4.46	SCD	
543	22157	ANTARES VESPERTIL	16.45427700	16.0	27.0	15.4	-26+3561100	-26.0	21.0	3.0	SCD
544	22142	16.46702700	16.0	28.0	1.3	-78+6222200	-78.0	49.0	2.0	SCD	
545	22193	KORNEPHOROS RUTILI	16.47855500	16.0	28.0	92.0	21+54172200	21.0	33.0	2.81	SCD
546	22195	16.48483300	16.0	29.0	5.4	-14+6497200	-14.0	47.0	4.53	SCD	
547	22200	16.48552700	16.0	29.0	7.0	-16+531805500	-16.0	32.0	4.46	SCD	
548	22203	16.48577700	16.0	29.0	8.0	-2+05916660	-2.0	3.0	4.46	SCD	
549	22221	16.50094400	16.0	30.0	3.4	-21+9305500	-21.0	23.0	9.0	SCD	
550	22294	16.54955500	16.0	32.0	56.4	-42+5083300	-42.0	30.0	4.57	SCD	
551	22303	16.56166600	16.0	33.0	42.0	-28+14500000	-28.0	8.0	2.91	SCD	

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

752	22311		16.0	34.0	4.0	-35.18527700	-35.0	11.0	7.0	4.3J	0	SCO
753	22332		16.0	35.0	13.7	-10.49777760	-10.0	29.0	52.0	2.7J	1.3	OPH
754	22370		16.0	36.0	1.9	-7.44777700	-7.0	26.0	32.0	0.6	0	APS
755	22464		16.0	39.0	57.9	31.0	54.0	39.0	3.0	4.6	0	HER
756	22502		16.0	41.0	41.0	3.8.98777700	36.0	59.0	16.0	3.6	4.4	M
757	22558	ATRIA	16.0	44.0	54.5	-68.96611000	-64.0	57.0	58.0	1.68	0	TRA
758	22606		16.0	46.0	45.2	-58.98168800	-58.0	58.0	53.0	3.6	0	H
759	22640		16.0	47.0	53.5	-34.0	13.0	53.0	2.3	2.6	E	
760	22643		16.0	47.0	53.7	-10.72277700	-10.0	43.0	22.0	4.73	2.0	OPH
761	22749		16.0	49.0	29.2	82.09750000	82.0	54.0	51.0	4.40	2.2	E
762	22677		16.0	49.0	29.7	-37.98916600	-37.0	59.0	21.0	3.9	0	SCO
763	22691		16.0	49.0	57.4	-37.95972700	-37.0	57.0	35.0	3.64	0	H
764	22751	GRAFIAS	16.0	50.0	6.9	-42.30333300	-42.0	18.0	12.0	3.75	0	Z
765	22775		16.0	52.0	21.0	10.22146650	10.0	13.0	18.0	4.29	2.5	OPH
766	22845		16.0	55.0	42.9	-55.93694000	-55.0	56.0	13.0	3.06	0	ARA
767	22842		16.0	56.0	6.6	9.42805550	25.0	51.0	34.0	3.42	2.7	K
768	22869		16.0	56.0	47.2	-53.10888800	-53.0	6.0	32.0	4.15	0	E
769	22935		16.0	58.0	56.9	30.97646600	30.0	58.0	36.0	3.92	5.8	E
770	23158	SABIK	17.0	6.0	22.1	-15.68333330	-15.0	41.0	0	3.5	H	OPH
771	23182	NODUS 1	17.0	6.0	40.9	45.07575000	45.0	27.0	32.0	2.2	2	DRA
772	23180		17.0	9.0	38.5	-43.19500000	-43.0	11.0	42.0	3.44	0	M
773	23277	RAS-ALGETHI	17.0	13.0	3.0	14.42888890	14.0	25.0	44.0	3.50	6.4	HER
774	23294	SARIN	17.0	13.0	35.5	-21.07916600	24.0	52.0	51.0	3.16	6.5	D
775	23302		17.0	13.0	49.4	36.84750000	36.0	50.0	51.0	3.36	6.7	P
776	23359		17.0	16.0	1.9	33.013666600	33.0	0.0	12.0	4.00V	6.8	HER
777	23392		17.0	16.0	19.4	-67.73666500	-67.0	44.0	12.0	4.74	0	APS
778	23424		17.0	16.0	51.4	-12.81305550	-12.0	48.0	47.0	4.35	5.3	N
779	23423		17.0	16.0	54.2	-21.07694400	-21.0	47.0	37.0	4.46	4.0	C
780	23451		17.0	19.0	24.4	24.96638800	-24.0	57.0	59.0	3.37	4.2	J
781	23515		17.0	22.0	23.1	-55.49996600	-55.0	29.0	57.0	2.80	0	B
782	23517		17.0	22.0	26.5	-56.03466400	-56.0	20.0	49.0	3.51	0	G
783	23544		17.0	22.0	28.4	37.17694400	37.0	10.0	37.0	4.52	0	RA
784	23597		17.0	24.0	13.8	-24.14500000	-24.0	8.0	42.0	4.28	4.4	OPH
785	23617		17.0	24.0	46.3	-5.05722222	-5.0	3.0	26.0	4.61	2.7	OPH
786	23621		17.0	24.0	46.6	4.16916660	4.0	10.0	9.0	4.44	4.9	S
787	23627		17.0	25.0	7.0	-29.83722200	-29.0	50.0	50.0	4.37	4.5	OPH
788	23681		17.0	27.0	56.0	-60.06566490	-60.0	39.0	25.0	3.79	0	ARA
789	23693		17.0	28.0	22.9	-37.27000000	-37.0	16.0	12.0	2.80	3.4	U
790	23708		17.0	29.0	7.9	-49.85655600	-49.0	51.0	2.0	2.97	0	A
791	23726	MAASYH	17.0	29.0	19.3	16.13583100	26.0	8.0	9.0	4.48	7.6	L
792	23741	ALWAID	17.0	29.0	38.4	52.03226390	52.0	19.0	35.0	2.99	2.3	DRA
793	23749	SHAULA	17.0	31.0	13.8	-37.08027700	-37.0	4.0	49.0	1.71	3.5	L
794	23815		17.0	33.0	3.0	-46.048361100	-46.0	29.0	1.0	4.63	0	ARA
795	23837	RAS-ALHAGUE	17.0	34.0	18.5	12.58416670	12.0	35.0	3.0	2.14	5.5	A
796	23846		17.0	34.0	8.0	-38.6124990	-38.0	36.0	4.34	0	SCD	
797	23857		17.0	34.0	48.0	-42.97750000	-42.0	58.0	39.0	2.04	0	K
798	23881		17.0	35.0	34.8	-15.37833320	-15.0	22.0	42.0	3.64	5.5	SER
799	23897		17.0	35.0	54.4	-8.09916670	-8.0	5.0	57.0	4.65	5.7	H
800	23965		17.0	36.0	28.5	4.60241660	4.0	1.0	27.0	3.79	8.5	UMI
801	23978		17.0	37.0	24.7	-12.85833330	-12.0	51.0	30.0	4.39	5.6	SER
802	23988		17.0	39.0	3.8	-39.01388900	-39.0	0.0	50.0	2.51	0	SCD
803	24048	KELB-ALRAI	17.0	41.0	44.5	-4.58027770	-4.0	34.0	49.0	2.94	4.0	OPH
804	24044		17.0	42.0	17.6	-6.47097220	-6.0	42.0	35.0	3.58	0	PAY
805	24236	PHERKARD	17.0	43.0	27.3	8.60407200	8.0	36.0	17.0	4.14	2.3	D
806	24138		17.0	45.0	5.2	27.73999900	27.0	44.0	24.0	3.48	0	HER
807	24125		17.0	45.0	8.1	-40.01152770	-40.0	4.0	4.0	3.14	0	SCD
808	24135		17.0	45.0	21.3	-27.81916600	-27.0	49.0	9.0	4.00V	3	SGR
809	24162		17.0	46.0	8.2	27.71888990	27.0	43.0	8.0	3.79	6.2	OPH

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

010 24168	17.79125000	47.0	28.5	-37.0	3.55	0
011 24364	GRUMIUM	17.88202700	17.0	52.0	55.0	3.90
012 24415		17.91527700	17.0	55.0	50.3	52.0
013 24432	ELTANIN	RASTABAN	17.92966000	17.0	55.0	56.0
014 24448		17.94055500	17.0	56.0	54.0	52.0
015 24468		17.95163800	17.0	57.0	54.9	50.0
016 24478		17.95269400	17.0	57.0	57.0	51.0
017 24502		17.97494400	17.0	58.0	59.8	51.0
018 24503		17.97719400	17.0	58.0	57.9	51.0
019 24509		17.98144900	17.0	58.0	54.4	51.0
020 24534		17.99996100	17.0	59.0	56.0	51.0
021 24605		18.04634800	18.0	2.0	47.0	50.0
022 24632	NASH	NUSHABAIB	059305000	18.0	3.0	33.5
023 24641		18.06141600	18.0	3.0	41.1	50.0
024 24645		18.06508000	18.0	3.0	54.0	50.0
025 24665		18.08680500	18.0	5.0	12.5	46.0
026 24693		18.09381300	18.0	5.0	37.8	48.0
027 24695		18.09480500	18.0	5.0	41.3	48.0
028 24694		18.09774900	18.0	5.0	51.9	48.0
029 24711		18.10291600	18.0	6.0	10.5	48.0
030 24740		18.12100000	18.0	7.0	15.4	48.0
031 24767		18.14383300	18.0	8.0	37.8	48.0
032 24856		18.19447100	18.0	11.0	40.0	48.0
033 24944		18.25427700	18.0	15.0	15.4	48.0
034 24961		18.264366000	18.0	15.0	51.7	48.0
035 25032		18.31055500	18.0	18.0	38.0	48.0
036 25024	KAUS-MEDIUM	18.31255500	18.0	18.0	45.2	48.0
037 25046		18.32494400	18.0	19.0	29.8	48.0
038 25045		18.333336100	18.0	20.0	1.1	48.0
039 25114		18.35433200	18.0	21.0	15.6	48.0
040 25122		18.36147200	18.0	21.0	41.3	48.0
041 25100	KAUS-AUSTR.	18.36413800	18.0	21.0	50.9	48.0
042 25116		18.37008300	18.0	22.0	12.3	48.0
043 25154		18.40630500	18.0	22.0	45.0	48.0
044 25180	KAUS-BORG	18.443016600	18.0	25.0	48.6	48.0
045 25183		18.45558300	18.0	26.0	8.1	48.0
046 25220		18.455336000	18.0	27.0	12.1	48.0
047 25313		18.51672200	18.0	31.0	2.2	48.0
048 25385		18.555027200	18.0	33.0	18.0	48.0
049 25466	VEGA	18.5958100	18.0	35.0	45.1	48.0
050 25522		18.649250000	18.0	36.0	57.3	48.0
051 25580		18.67261000	18.0	40.0	21.4	48.0
052 25668		18.72033300	18.0	43.0	13.2	48.0
053 25661		18.7450000	18.0	43.0	28.2	48.0
054 25676		18.72608300	18.0	43.0	33.9	48.0
055 25698		18.73588800	18.0	44.0	9.2	48.0
056 25730		18.75527700	18.0	45.0	19.0	48.0
057 25734		18.76022100	18.0	45.0	16.1	48.0
058 25735		18.8131000	18.0	53.0	16.7	48.0
059 25847	SHELIAK	18.81630500	18.0	53.0	21.0	48.0
060 25823		18.8491600	18.0	53.0	16.1	48.0
061 25941	NUNKI	18.88780500	18.0	53.0	16.1	48.0
062 25954		18.88780500	18.0	53.0	16.1	48.0
063 25959		18.8879100	18.0	53.0	16.1	48.0
064 25910		18.88916600	18.0	53.0	21.0	48.0
065 25996		18.8947100	18.0	54.0	16.1	48.0
066 25991	ALYA	18.90797200	18.0	54.0	26.7	48.0
067 26019		18.92736000	18.0	54.0	38.5	48.0

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

868	26086	SULAPHAT	18.96055500	18.0	57.0	38.0	32.64027700	32.0	25.0	38.0	32.0	3.0	14.6	
869	26091		18.96722200	18.0	58.0	2.0	15.01944440	15.0	10.0	4.21	1.3	E	AQL	
870	26141		18.996831600	18.0	59.0	48.6	15.76972220	-5.0	47.0	23.0	4.15	I2	AQL	
871	26161	ASCCELLA	19.00641600	19.0	0.	23.0	-2.9.93194400	-29.0	55.0	55.0	2.71	38	Z	SGR
872	26224		19.04308300	19.0	2.0	35.1	-21.79444400	-21.0	47.0	40.0	4.70	3.70	SGR	
873	26270		19.06333300	19.0	3.0	48.0	1.3.81000000	13.0	48.0	36.0	3.02	1.7	Z	AQL
874	26223		19.06755500	19.0	4.0	3.2	-37.11527700	-37.0	6.0	55.0	4.26	0	G	CRA
875	26285		19.07316600	19.0	4.0	23.4	-4.9.3636880	-4.0	56.0	11.0	3.55	1.6	L	AQL
876	26291		19.07924900	19.0	4.0	45.3	-27.72333100	-27.0	43.0	24.0	4.42	4.0	T	SGR
877	26322		19.07855500	19.0	5.0	54.8	-40.55227700	-40.0	33.0	10.0	4.66	0	D	CRA
878	26360		19.1182200	19.0	7.0	5.6	-37.9.60833300	-37.0	57.0	39.0	4.12	0	A	CRA
879	26380		19.2702700	19.0	7.0	37.3	-39.39833300	-39.0	23.0	54.0	4.16	0	B	CRA
880	26386		19.12802700	19.0	7.0	40.9	-21.0.080833300	-21.0	4.0	51.0	3.02	4.1	P	SER
881	26520	NODUS II	ALDIBI 19.2916600	19.0	12.0	33.0	67.599999900	67.0	36.0	0	3.24	5.7	D	DRA
882	26507		19.2041600	19.0	12.0	33.9	39.0.08472200	39.0	5.0	5.0	4.46	2.0	M	LYR
883	26569		19.24516600	19.0	14.0	42.6	21.3.327494900	21.0	19.0	39.0	4.40	1	VUL	
884	26585		19.25252700	19.0	15.0	9.1	38.0.07027700	38.0	4.0	13.0	4.46	2.1	J	LYR
885	26638		19.27058200	19.0	16.0	14.1	17.3.29111100	17.0	28.0	4.63	6.0	T	DRA	
886	26621		19.27155500	19.0	16.0	17.4	53.0.303333300	53.0	18.0	12.0	3.98	1	K	CYG
887	26694		19.32239800	19.0	19.0	38.6	-17.9.1472200	-17.0	54.0	53.0	3.95	4.4	R	SGR
888	26697		19.3286400	19.0	19.0	43.3	-16.02222200	-16.0	20.0	20.0	4.58	4.6	U	SER
889	26703	ARKAB-PRIOR	19.33518800	19.0	20.0	7.4	-44.52666600	-44.0	31.0	36.0	4.28	0	S	DRA
890	26735		19.34152700	19.0	20.0	29.5	65.64694300	65.0	38.0	49.0	4.63	5.8	P	DRA
891	26737	ARKAB-POSTERIOR	19.34448800	19.0	20.0	41.6	-44.8.67499900	-44.0	52.0	3.0	4.51	0	B	SER
892	26737	ALRAMI	RUBAT 19.35772200	19.0	21.0	27.8	-40.6.68361100	-40.0	41.0	1.0	4.11	0	A	SER
893	26816	DENEB OKAB	19.39555500	19.0	23.0	44.0	3.04361140	3.0	2.0	37.0	3.44	3.0	D	AQL
894	26904		19.45413800	19.0	27.0	14.9	24.59277700	24.0	35.0	34.0	4.63	4	A	VUL
895	26947		19.48038900	19.0	28.0	49.4	51.64544400	51.0	39.0	16.0	3.94	10	I	CYG
896	26953	ALBIRED	19.4884200	19.0	29.0	18.5	27.8.85000000	27.0	53.0	6.0	3.24	4	B	CYG
897	27030		19.53963900	19.0	32.0	22.7	7.30333330	7.0	18.0	12.0	4.65	3.8	H	AQL
898	27089		19.57630500	19.0	34.0	34.7	-24.9.6250000	-24.0	57.0	45.0	4.66	5.2	S	SER
899	27103		19.5818300	19.0	34.0	54.6	-1.36555554	-1.0	21.0	56.0	4.28	4.1	I	AQL
900	27141		19.59169400	19.0	35.0	30.1	50.1.13916600	50.0	8.0	21.0	4.64	13	J	CYG
901	27215	SHAM	19.64216400	19.0	38.0	31.8	17.6.2194400	17.0	55.0	55.0	4.37	5	E	DRA
902	27236		19.65791600	19.0	39.0	28.5	17.3.9161100	17.0	23.0	37.0	4.45	4	E	SER
903	27347		19.73130500	19.0	43.0	52.0	45.0.0444400	45.0	2.0	40.0	2.97	4.8	O	CYG
904	27354	REDA	TARAZED 19.74325000	19.0	44.0	35.7	10.52444660	10.0	31.0	36.0	50.6	52	M	ABL
905	27391		19.76377700	19.0	45.0	49.4	18.44666600	18.0	26.0	48.0	3.76	7	S	SER
906	27471	TYL	19.80499900	19.0	48.0	18.0	70.1.7888600	70.0	10.0	44.0	3.99	6.3	E	DRA
907	27470	ALTAIR	19.81791600	19.0	49.0	4.5	8.77444440	6.0	46.0	28.0	4.69	6.3	A	AQL
908	27481		19.82030500	19.0	49.0	13.1	32.82444400	32.0	49.0	28.0	4.00V	4.00V	X	CYG
909	27517		19.84483300	19.0	50.0	41.4	9.14444443	9.0	54.0	52.0	5.00V	5.00V	H	CYG
910	27544		19.86619400	19.0	51.0	58.3	23.9872200	23.0	59.0	14.0	4.50	1.3	VUL	
911	27557		19.88083300	19.0	52.0	51.0	41.9.96194400	41.0	57.0	43.0	4.21	0	I	SER
912	27587	ALSHAIN	19.89322200	19.0	53.0	35.4	6.31805550	6.0	19.0	5.0	3.90	6.0	B	AQL
913	27605		19.91336000	19.0	54.0	48.1	27.6416600	-27.0	51.0	4.62	5.69	5.69	S	SER
914	27622		19.91652700	19.0	54.0	59.5	34.98944400	34.0	59.0	22.0	4.03	2.1	H	CYG
915	27631		19.94291600	19.0	56.0	34.5	7.3056300	-7.0	4.0	21.0	4.10	0	E	PAY
916	27672		19.95330500	19.0	57.0	11.9	19.39583300	19.0	23.0	45.0	3.71	12	G	SER
917	27670		19.95769400	19.0	57.0	27.7	35.37277700	-35.0	22.0	4.39	0	0	J	CEP
918	27753		19.979430500	19.0	59.0	39.5	27.65583100	27.0	39.0	21.0	4.74	15	VUL	
919	27763		20.00847200	20.0	0	30.5	-27.80864000	-27.0	48.0	31.0	4.60	6.2	D	DRA
920	27856		20.04441600	20.0	2.0	39.9	67.77361100	67.0	46.0	25.0	4.66	6.7	R	DRA
921	27886		20.08847100	20.0	5.0	18.5	-6.6.27361100	-6.0	46.0	16.0	2.64	0	O	PAY
922	28010		20.15830500	20.0	9.0	29.9	-9.26666645	-9.0	55.0	36.0	3.37	4.5	J	ABL
923	28066		20.16836000	20.0	10.0	6.1	77.60694400	77.0	36.0	25.0	4.40	1	K	CEP
924	28099		20.20880500	20.0	12.0	31.7	46.63344400	46.0	38.0	4.0	3.95	31	O	CYG
925	28108		20.20974900	20.0	12.0	35.1	56.0459999900	56.0	27.0	36.0	4.32	33	C	CYG

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

926	28152		20+0	14+0	19+0	27+0	42+0	21+0	21+0	23+0	VUL
927	28160		20+0	14+0	23+3	47+6	60+1	11+0	36+0	22+0	CY G
928	28189		20+0	15+0	42+5	-12+6	61+7	77+7	37+0	4+0	CAP
929	28200	GREDI	20+0	16+0	6+8	-12+6	54+7	24+0	39+0	17+0	CAP
930	28295	DABIH	20+3	17+4	16+0	2+7	-14+8	93+3	33+3	-14+0	53+0
931	28338	SADOR	20+0	20+0	58+2	40+1	43+8	88+0	40+0	8+0	37+0
932	28378		20+0	20+0	22+0	22+6	32+0	07+6	11+0	32+0	CY G
933	28374	PEACOCK	20+0	22+0	53+3	-56+8	49+1	64+0	-54+0	50+0	57+0
934	28513		20+0	27+0	57+8	30+0	25+0	83+3	00+0	30+0	57+0
935	28541		20+0	28+0	59+8	62+8	76+1	11+0	62+0	52+0	54+0
936	28593		20+0	20+0	32+4	11+1	18+3	05+5	11+0	10+0	59+0
937	28659		20+0	20+0	40+3	14+5	52+4	99+0	14+0	33+0	9+0
938	28682		20+0	20+0	35+0	6+7	-47+4	14+9	99+0	-47+0	24+0
939	28709	ROTANEV	20+0	20+0	54+4	14+4	47+2	22+2	22+0	28+0	54+0
940	28725		20+0	20+0	31+8	-1+1	22+8	6+1	11+0	15+0	4+0
941	28780	SVALOCIN	20+0	20+0	38+0	-0+7	15+7	87+4	99+0	15+0	47+0
942	28846	DENE B CYGNI	20+0	20+0	40+0	14+2	45+1	54+4	44+0	9+0	45+0
943	28860		20+0	20+0	41+0	28+6	-52+0	04+7	74+9	-52+0	2+0
944	28873		20+0	20+0	41+0	49+9	14+9	47+7	77+7	14+0	54+0
945	28862		20+0	20+0	41+0	49+5	-66+6	3+0	8+2	20+0	3+0
946	28929		20+0	20+0	36+0	31+8	-1+1	22+8	6+1	13+0	43+0
947	28942		20+0	20+0	44+0	1+5	-25+3	98+0	5+50	15+0	3+0
948	28956		20+0	20+0	44+0	12+9	3+0	59+1	11+0	10+0	59+0
949	28962		20+0	20+0	44+0	29+0	57+0	45+3	6+100	9+0	4+0
950	28959	GLENAH	20+0	20+0	44+0	34+6	16+1	74+7	77+7	14+0	52+0
951	28966		20+0	20+0	44+0	47+6	61+0	70+2	50+0	52+0	4+53
952	28978	ALBALI	20+0	20+0	45+0	2+0	-66+6	3+0	24+0	19+0	0+0
953	28979		20+0	20+0	45+0	46+0	15+9	97+2	22+0	53+0	53+0
954	28994		20+0	20+0	45+0	53+4	-9+0	62+4	99+0	35+0	52+0
955	29079		20+0	20+0	46+0	2+6	57+0	45+3	6+100	13+0	4+0
956	29150		20+0	20+0	46+0	3+6	36+0	3+6	11+0	17+0	4+0
957	29133		20+0	20+0	47+0	4+4	-27+0	05+1	38+8	50+0	17+0
958	29251		20+0	20+0	47+0	5+6	44+0	28+8	80+0	50+0	17+0
959	29331		20+0	20+0	47+0	6+9	-32+0	39+5	81+300	32+0	13+0
960	29459		21+0	21+0	3+0	39+3	43+0	78+5	00+00	4+0	4+0
961	29460		21+0	21+0	3+0	56+9	-17+3	73+0	5+500	17+0	23+0
962	29490		21+0	21+0	5+0	5+0	44+0	25+3	83+8	80+0	17+0
963	29571		21+0	21+0	52+0	52+0	15+9	97+2	22+0	53+0	53+0
964	29661		21+0	21+0	55+0	52+0	-5+0	15+6	94+4	9+0	4+0
965	29591		21+0	21+0	59+0	6+9	-5+0	15+6	94+4	9+0	4+0
966	29723		21+0	22+3	1+300	21+0	46+5	9+8	64+6	9+0	51+0
967	29735		21+0	22+3	1+300	21+0	56+9	-17+3	73+0	53+0	4+19
968	29786		21+0	22+3	1+300	21+0	56+9	-25+0	14+4	5+0	4+19
969	29802		21+0	22+4	1+100	21+0	56+9	-11+5	44+4	4+0	4+19
970	29819		21+0	22+4	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
971	29848	ALDERAMIN	21+0	22+5	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
972	29903		21+0	22+5	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
973	29914		21+0	23+1	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
974	29979		21+0	23+1	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
975	30020		21+0	24+0	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
976	30059		21+0	24+0	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
977	30118	ALPHIRK	21+0	24+0	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
978	30137	SADALSUD	21+0	24+1	1+100	21+0	56+9	-32+0	34+0	4+0	4+19
979	30207		21+0	24+1	1+94+0	21+0	56+9	-32+0	34+0	4+0	4+19
980	30252		21+0	24+1	1+94+0	21+0	56+9	-32+0	34+0	4+0	4+19
981	30289		21+0	24+1	1+94+0	21+0	56+9	-32+0	34+0	4+0	4+19
982	30320	NASHIRA	21+0	24+1	1+94+0	21+0	56+9	-32+0	34+0	4+0	4+19
983	30440	ERAKIS	21+0	24+1	1+94+0	21+0	56+9	-32+0	34+0	4+0	4+19

TABLE I. - STAR IDENTIFICATION CATALOGUE - Continued

TABLE I. - STAR IDENTIFICATION CATALOGUE - Concluded

1042	32061	22.0	58.0	49.3	-52.94222200	-52.0	56.0	32.0	4.18	0 2
1043	32095	23.0	0.0	18.3	42.13749900	42.0	8.0	15.0	3.6UV	1 0 AND
1044	32135	SCHEAT	23.0	2.0	4.4	27.89249900	27.0	53.0	53.0	2.61 PEG
1045	32134		23.0	2.0	5.6	3.63138800	3.0	37.0	53.0	4.59 PSC
1046	32149	MARKAB	23.0	3.0	0.9	15.01666670	15.0	1.0	0.0	2.57 PEG
1047	32184		23.0	4.0	54.8	-13.70999900	-43.0	42.0	36.0	4.35 GRU
1048	32196		23.0	5.0	14.4	9.21999990	9.0	13.0	12.0	4.69 PEG
1049	32237		23.0	6.0	46.7	75.19833200	75.0	11.0	54.0	3.54 CEP
1050	32246		23.0	7.0	34.9	-21.36277700	-21.0	21.0	46.0	3.8U ABR
1051	32270		23.0	8.0	23.0	-45.43666600	-45.0	26.0	12.0	4.10 GRU
1052	32316		23.0	10.0	56.4	49.21472100	49.0	12.0	53.0	4.62 AND
1053	32346		23.0	12.0	30.5	-6.23805550	-6.0	14.0	17.0	4.40 AGR
1054	32374		23.0	14.0	3.5	-9.27861150	-9.0	16.0	43.0	4.46 PSC
1055	32415		23.0	15.0	21.0	2.09083300	3.0	5.0	27.0	3.85 G
1056	32413		23.0	15.0	23.8	-58.42605500	-58.0	25.0	41.0	0 G TUC
1057	32429		23.0	16.0	5.1	-9.37378890	-9.0	22.0	26.0	4.56 93 Y AGR
1058	32450		23.0	16.0	56.2	-32.72305500	-32.0	43.0	23.0	4.51 SCL
1059	32503	KERB	23.0	18.0	54.1	23.54986100	23.0	32.0	55.0	4.65 PEG
1060	32540		23.0	21.0	8.0	-20.29194400	-20.0	17.0	31.0	4.20 AGR
1061	32585		23.0	23.0	37.7	23.21111000	23.0	12.0	40.0	4.57 PEG
1062	32594		23.0	24.0	12.5	-20.03416600	-20.0	50.0	3.0	4.52 99 AGR
1063	32647		23.0	26.0	11.4	4.618638890	4.0	11.0	11.0	4.45 PSC
1064	32667		23.0	27.0	22.9	12.66722210	12.0	34.0	2.0	4.67 PEG
1065	32744		23.0	31.0	5.9	-38.01222100	-38.0	0.0	44.0	4.46 SCL
1066	32832		23.0	35.0	50.6	46.26833300	46.0	16.0	4.00 AND	
1067	32850		23.0	36.0	24.8	43.07416600	43.0	4.0	27.0	4.28 17 L
1068	32875	ALRAI	23.0	37.0	53.6	77.43694300	77.0	26.0	13.0	3.42 CEP
1069	32879		23.0	38.0	8.9	54.43638890	5.0	26.0	11.0	4.28 17 I
1070	32886		23.0	38.0	40.6	44.01400000	44.0	8.0	24.0	4.33 19 K
1071	32917		23.0	40.0	15.5	15.58749999	1.0	35.0	15.0	4.61 PSC
1072	32931		23.0	40.0	54.4	-14.73861140	-14.0	44.0	19.0	4.62 105 W AGR
1073	33050		23.0	47.0	6.3	-28.012388900	-28.0	19.0	26.0	4.64 SCL
1074	33160		23.0	52.0	37.5	57.30472100	57.0	18.0	17.0	4.0UV CAS
1075	33210		23.0	55.0	58.2	24.94694400	24.0	56.0	49.0	4.75 PEG
1076	33262		23.0	57.0	30.7	6.66944400	6.0	40.0	40.0	4.03 28 W PSC
1077	33280		23.0	58.0	6.6	-65.7194400	-65.0	46.0	19.0	4.71 0 E TUC
1078	33321		23.0	59.0	49.3	-77.25888800	-77.0	32.0	0 J OCT	
AZM =	279.112310									
LAT =	-3.631588									
LON =	-155.314000									

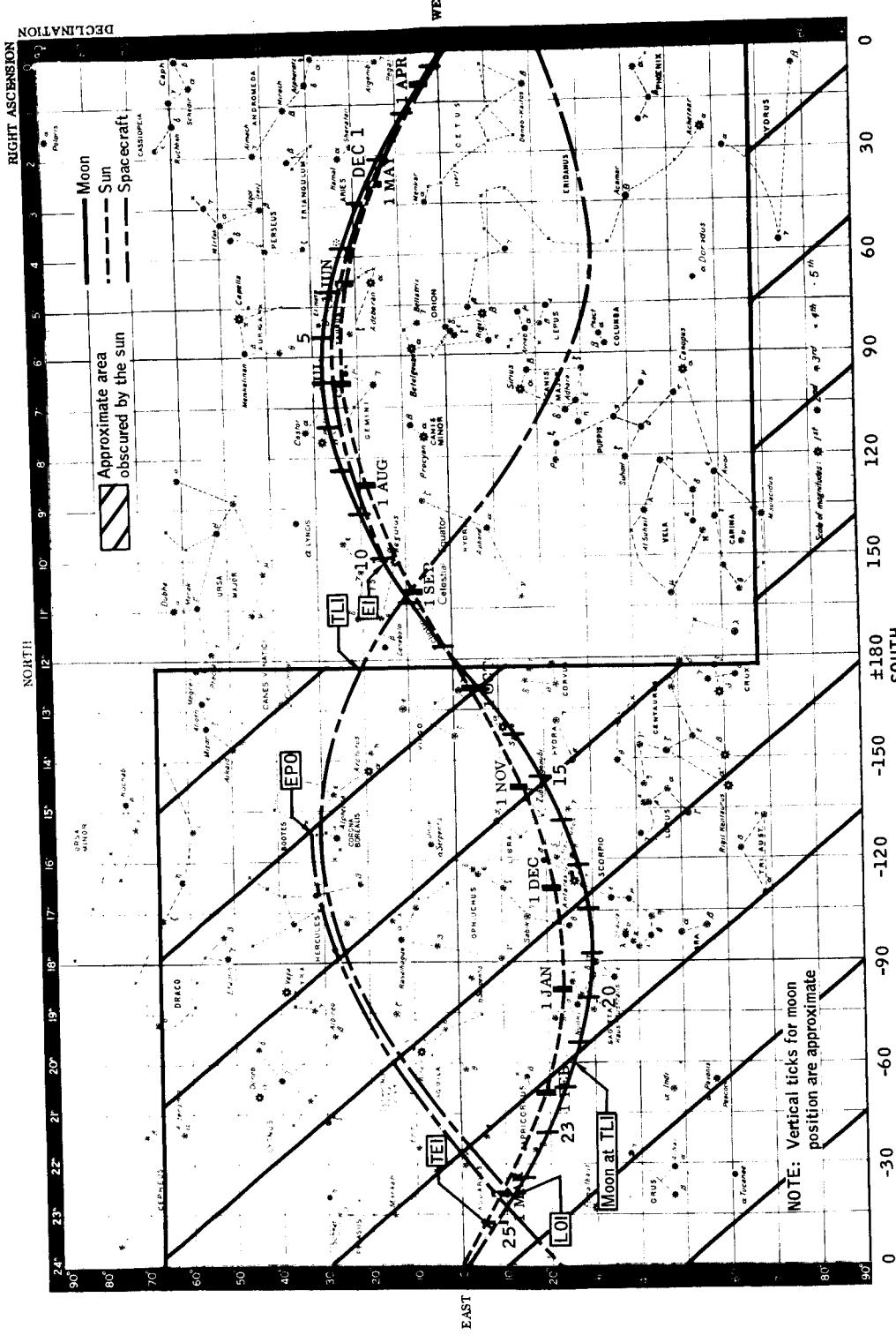


Figure 1.—The nominal Apollo 8 mission on a map of the celestial sphere.

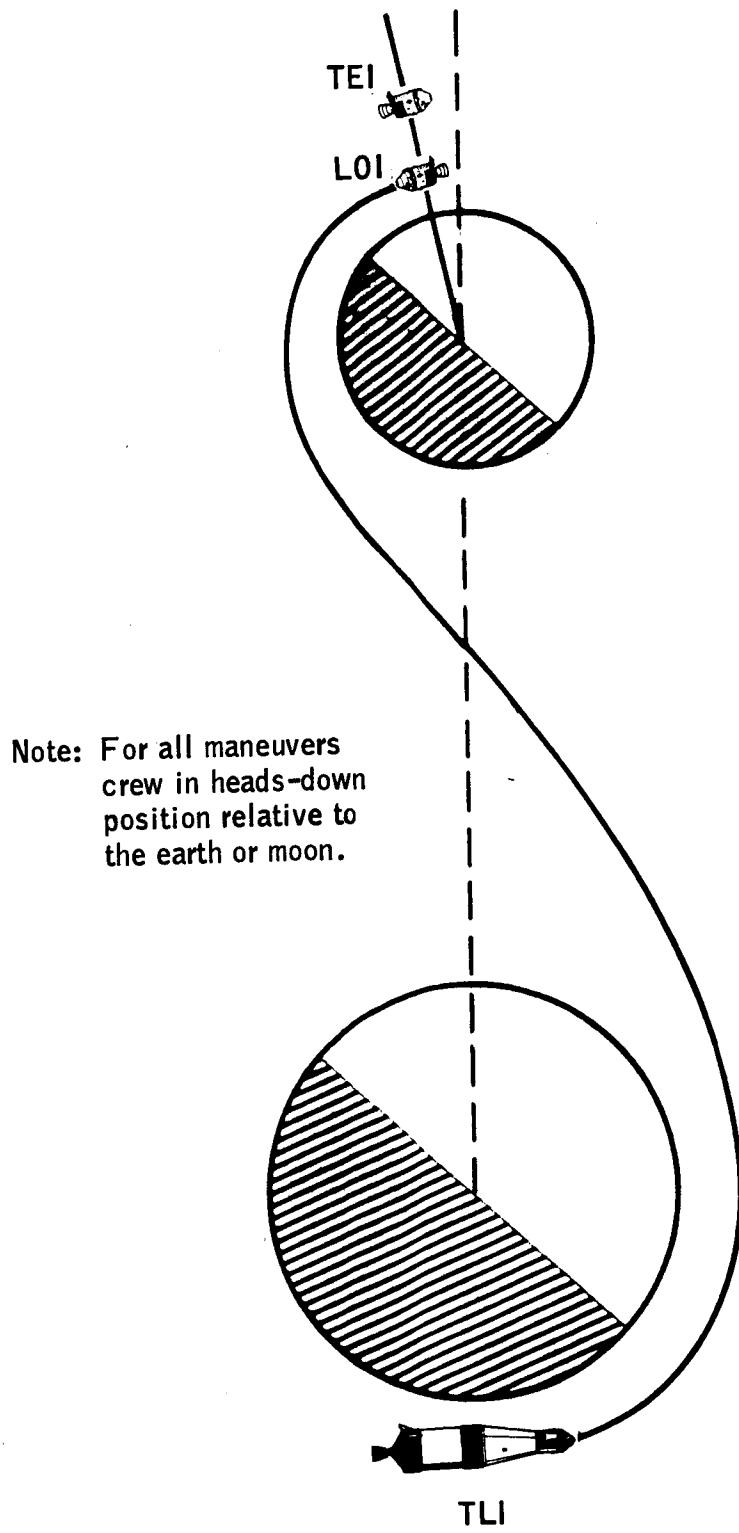


Figure 2.- A schematic of the maneuver attitudes and lighting for the nominal mission.

SEQ	507	509	540	577	580	592	604	610	624	639	651	655	658
X	-21	23	17	15	6	13	10	-5	-6	3	-2	-24	21
Y	-23	-21	-23	-18	-23	-17	-17	-20	-18	-14	-14	-12	-8

	673	690	700	740	745	753	755	770	798	795	813
-21	-2	-13	14	-5	-20	0	-22	11	-8	11	
-9	-8	-7	-4	-2	0	-1	8	0	6	2	

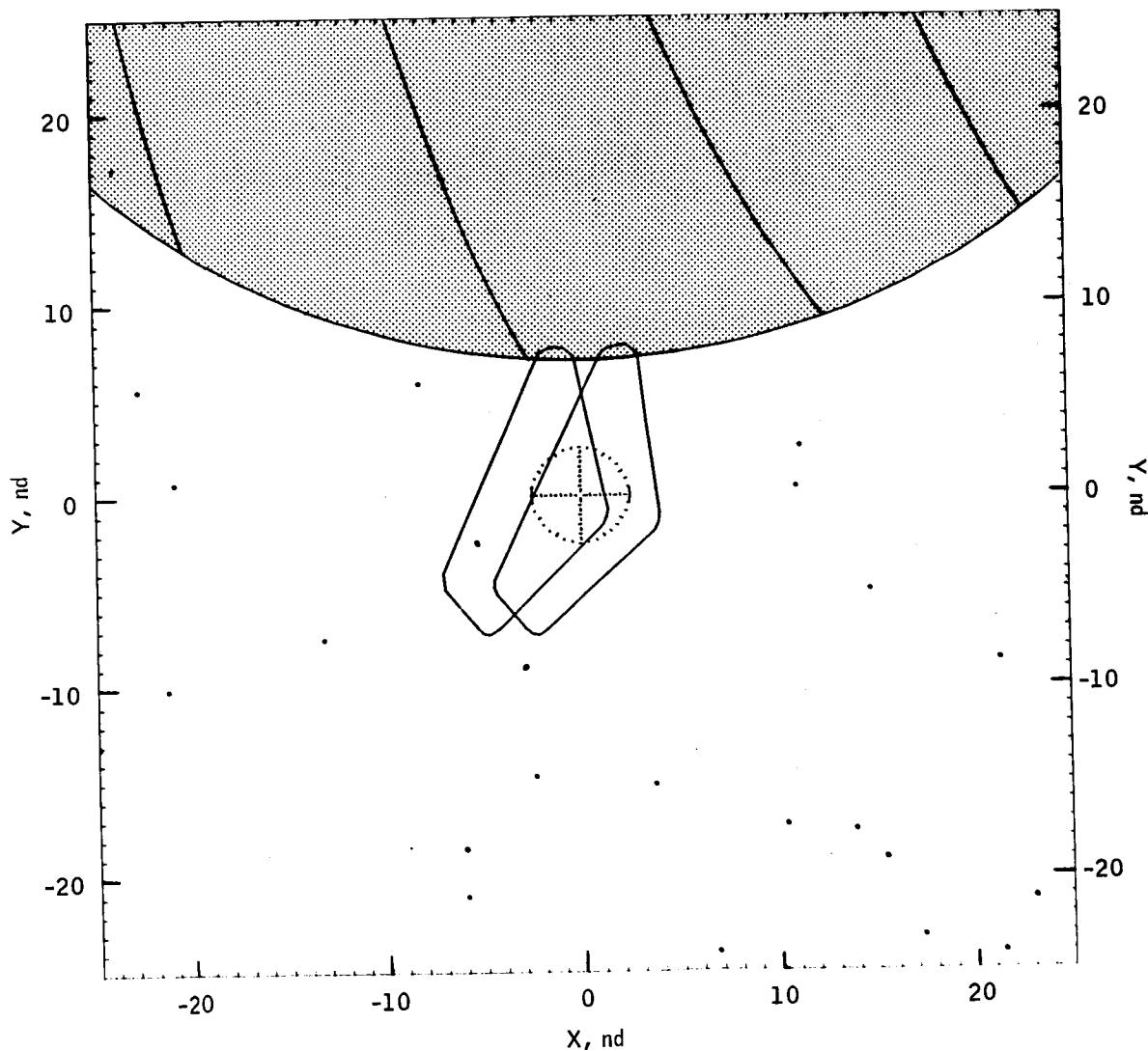


Figure 3a.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
Begin TLI burn.

SEQ	509	577	592	604	624	639	651	658	673	690	700	740	745
X	-24	16	14	10	-6	3	-2	22	-21	-2	-13	15	-5
Y	-24	-22	-21	-21	-22	-19	-18	-11	-13	-13	-11	-8	-6

SFG	753	755	770	792	795	803	813	849	903	971
X	-20	0	-22	11	-7	-11	11	6	12	23
Y	-2	-6	2	-3	1	4	-1	4	8	6

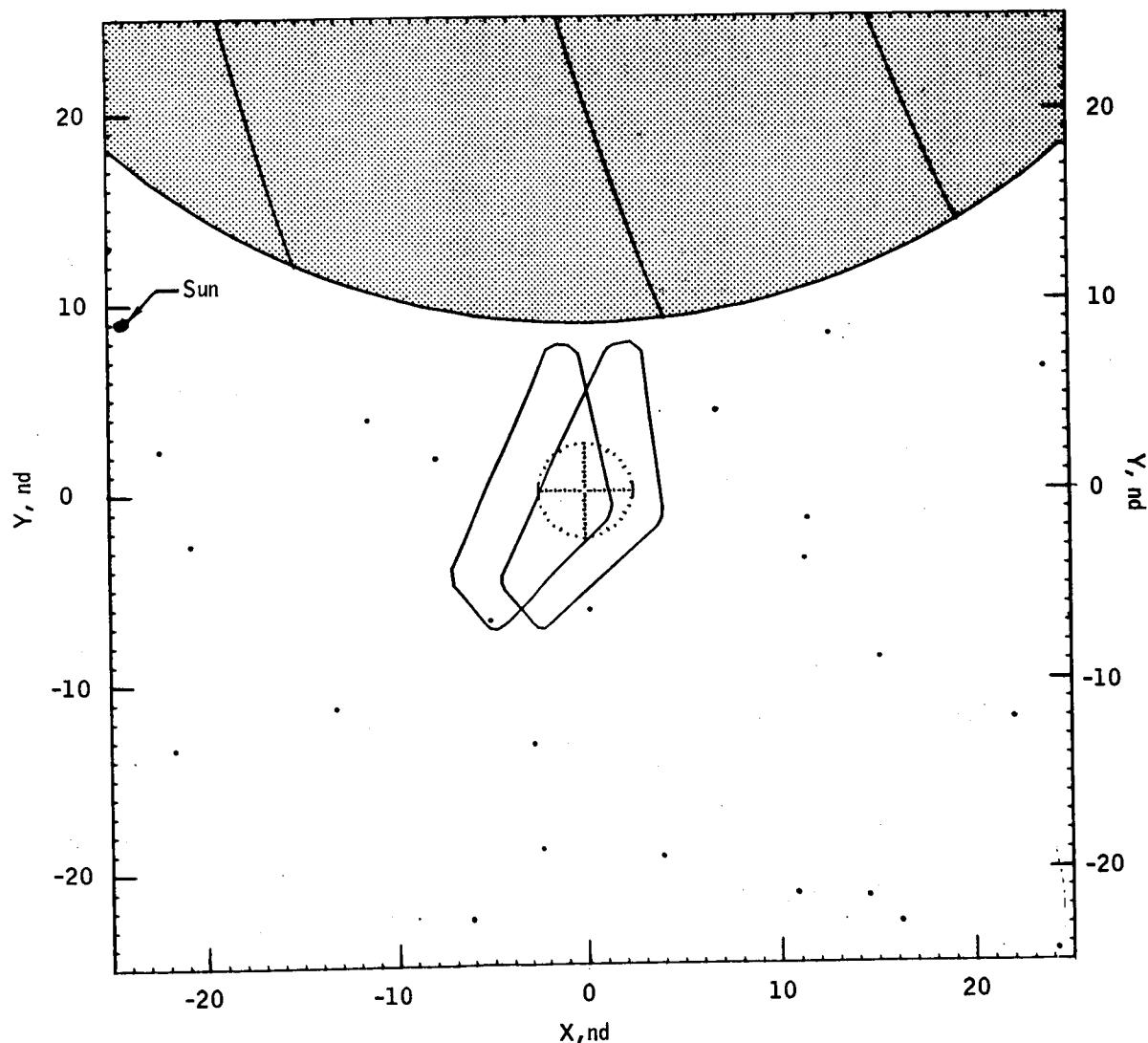


Figure 3b.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
Middle of TLI burn.

SEQ	639	651	658	673	690	700	740	745	753	755	770	792	795
X	4	-1	23	-21	-2	-12	16	-4	-19	1	-21	12	-6
Y	-23	-23	-15	-16	-17	-15	-13	-11	-6	-10	-1	-7	-2

SEG	803	813	844	849	903	904	931	942	950	971
X	-10	12	-22	7	13	-1	13	16	12	24
Y	0	-5	9	0	3	12	8	8	12	2

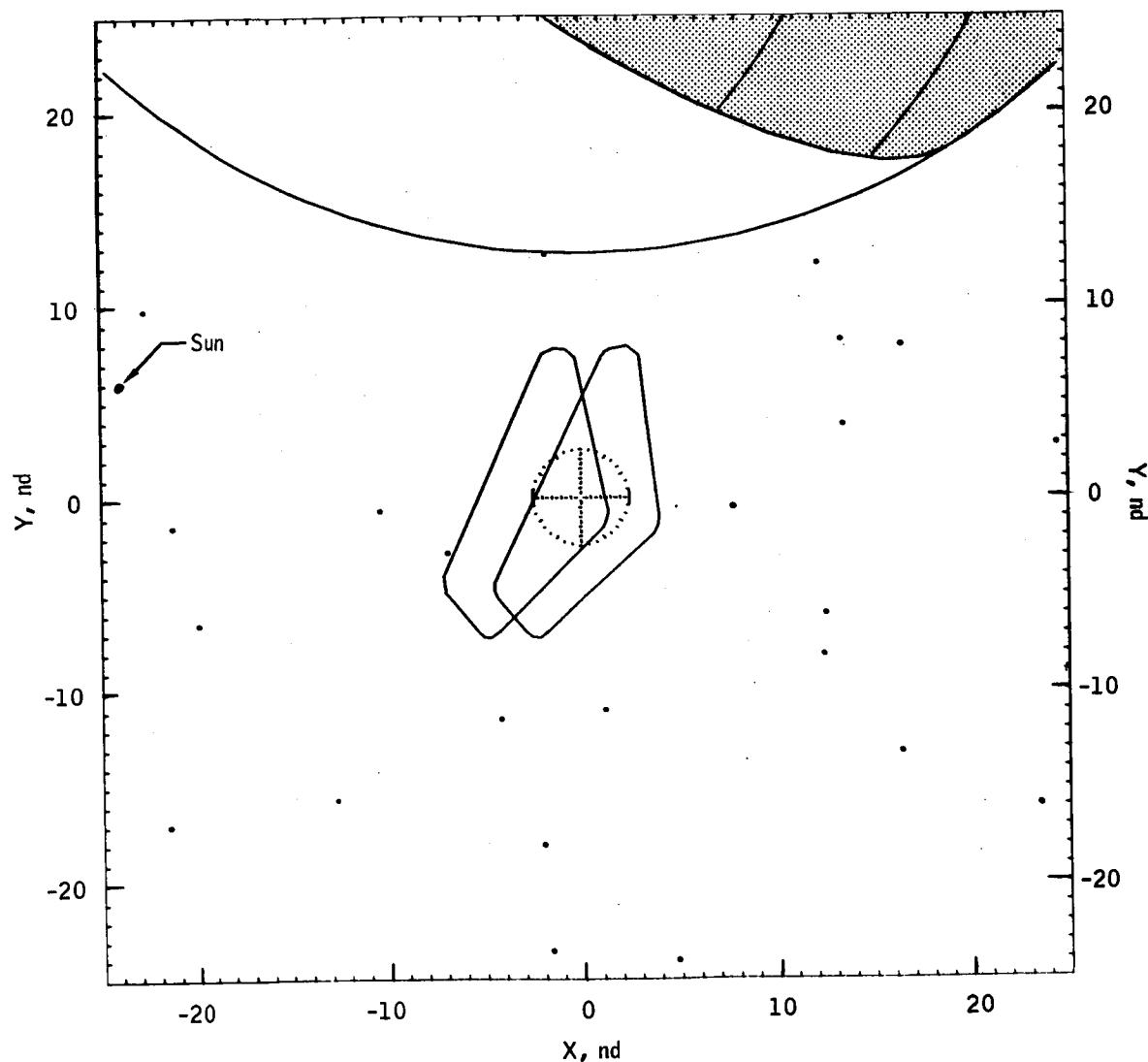


Figure 3c. - Launch date December 21, 1968; 72° launch azimuth; first opportunity.
End of TLI burn.

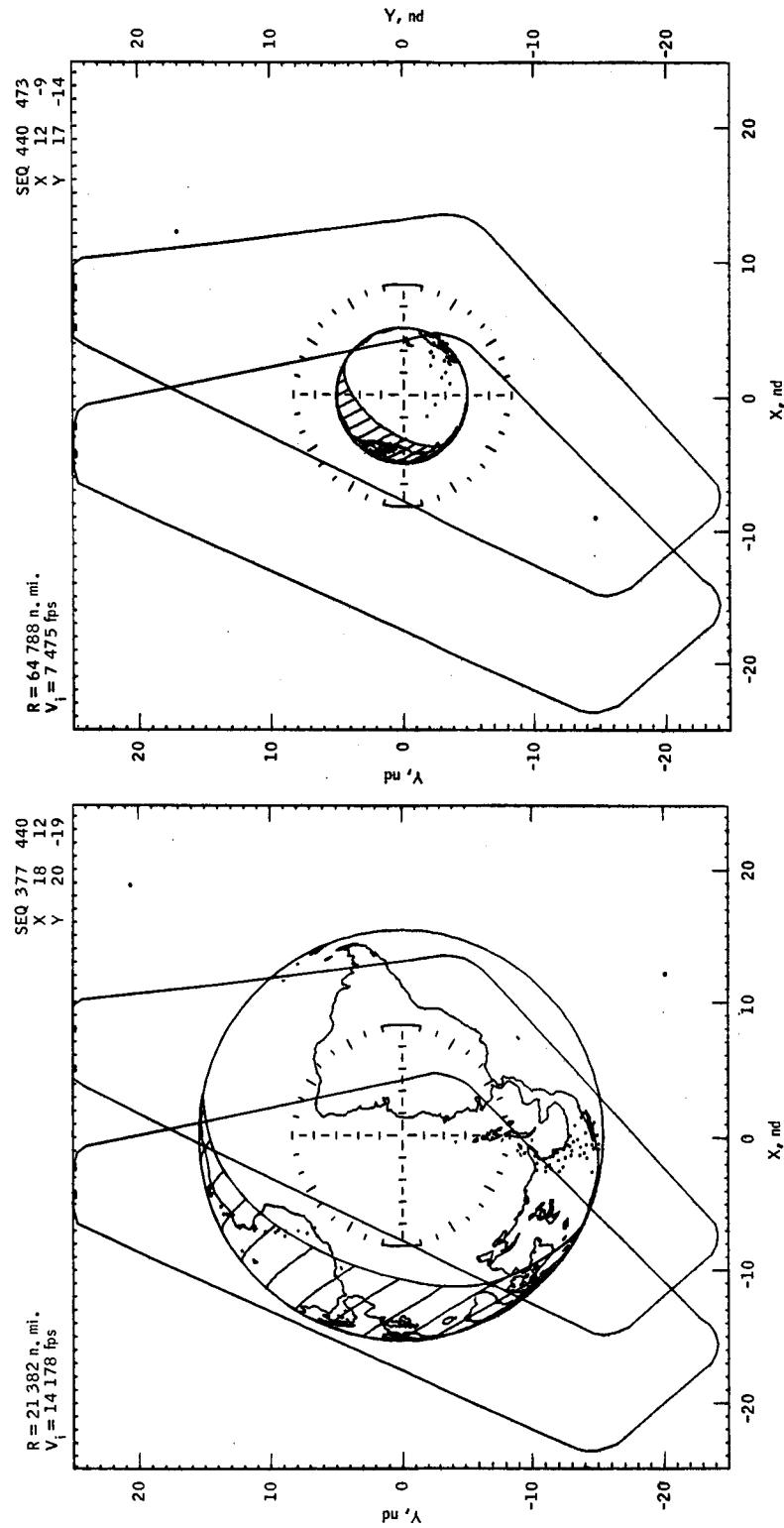
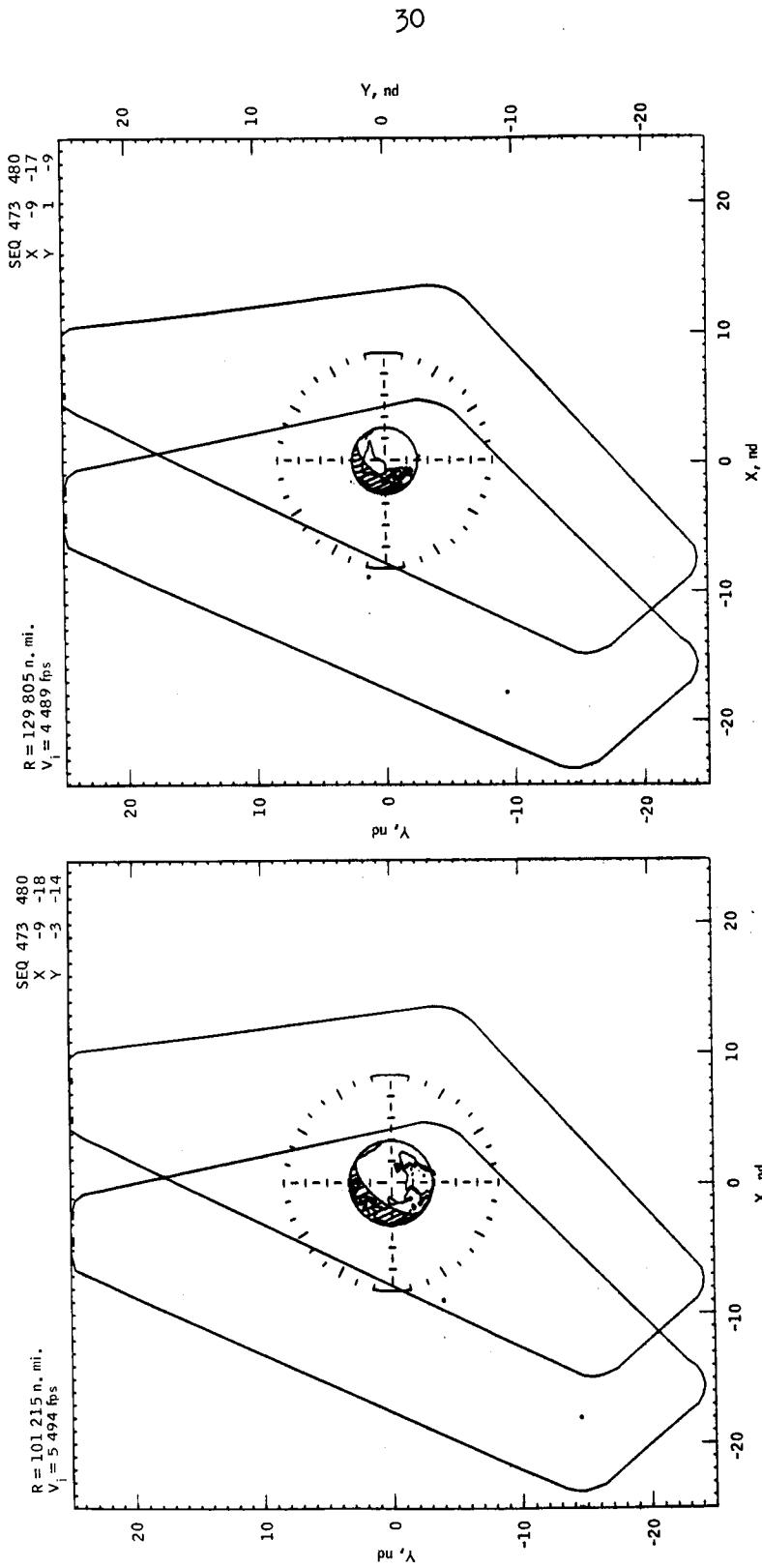


Figure 4. - Launch date December 21, 1968; 72° launch azimuth; first opportunity,
Translunar coast.

(a) Time from TLI cutoff = 2 hr.
(b) Time from TLI cutoff = 10 hr.

Figure 4. - Continued.

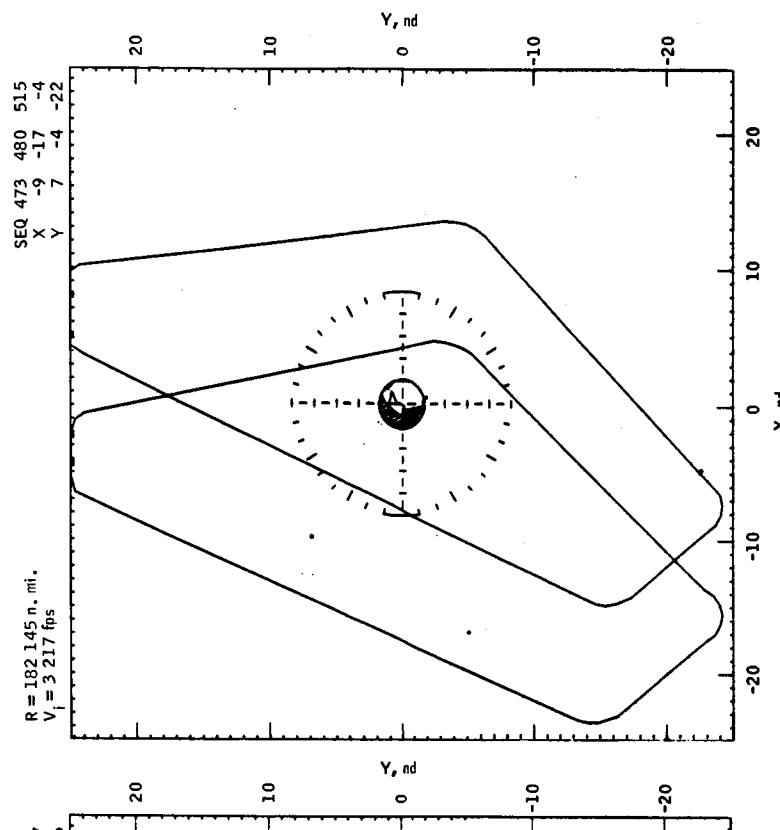


(d) Time from TLI cutoff ≈ 30 hr.

(c) Time from TLI cutoff ≈ 20 hr.

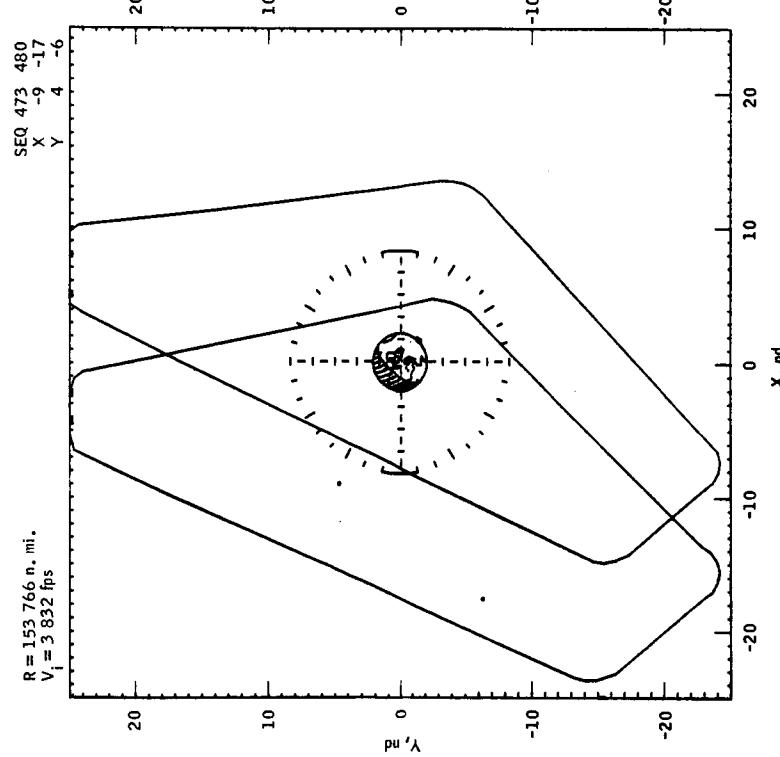
Figure 4. - Continued.

31



(e) Time from TLI cutoff = 40 hr.

Figure 4.- Continued.



(f) Time from TLI cutoff = 54 hr.

Figure 4.- Concluded.

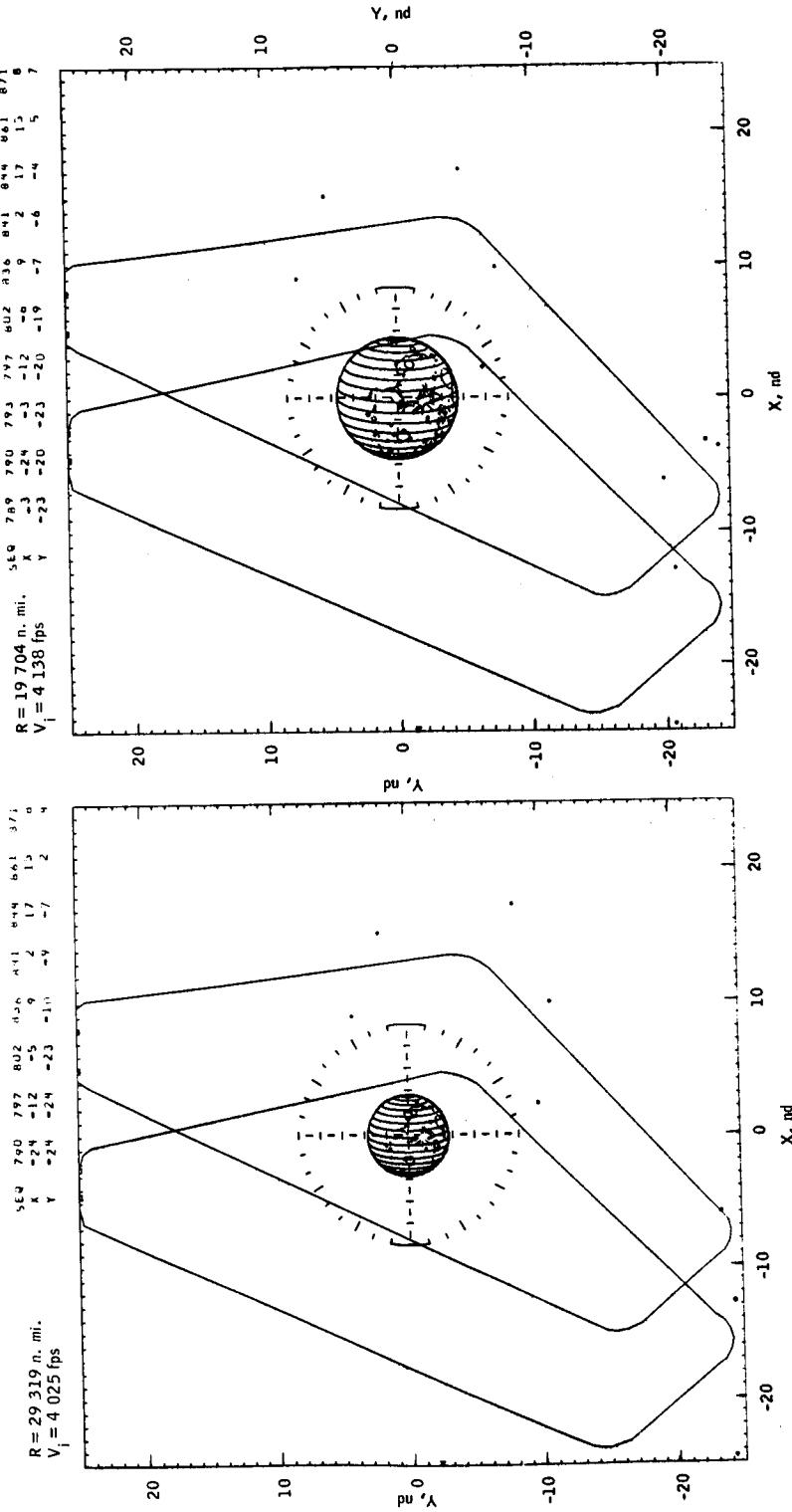


Figure 5.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
Translunar coast (moon referenced).

(a) Time from TLI cutoff ≈ 55 hr.
(b) Time from TLI cutoff $= 59$ hr.

Figure 5.- Continued.

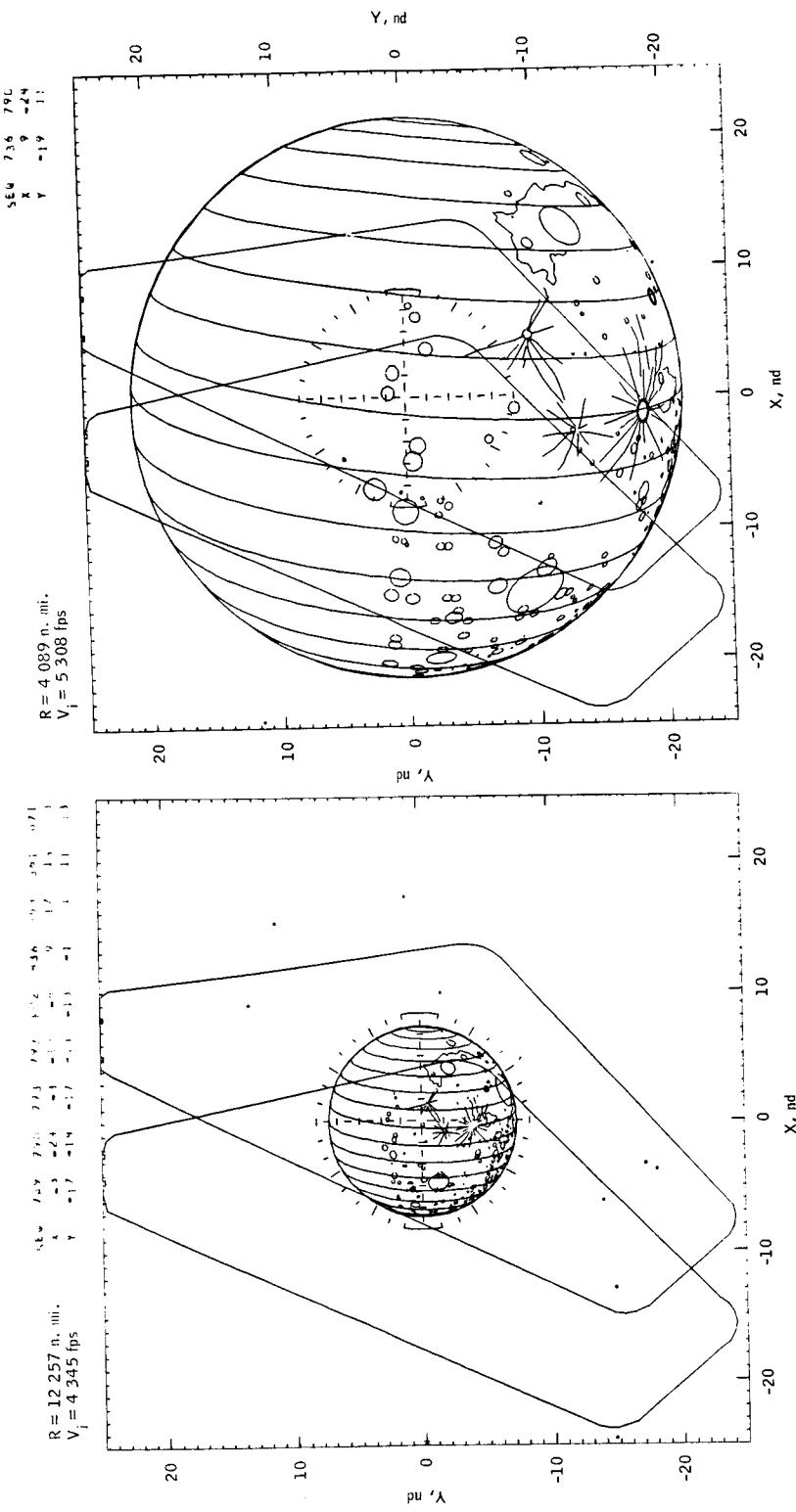
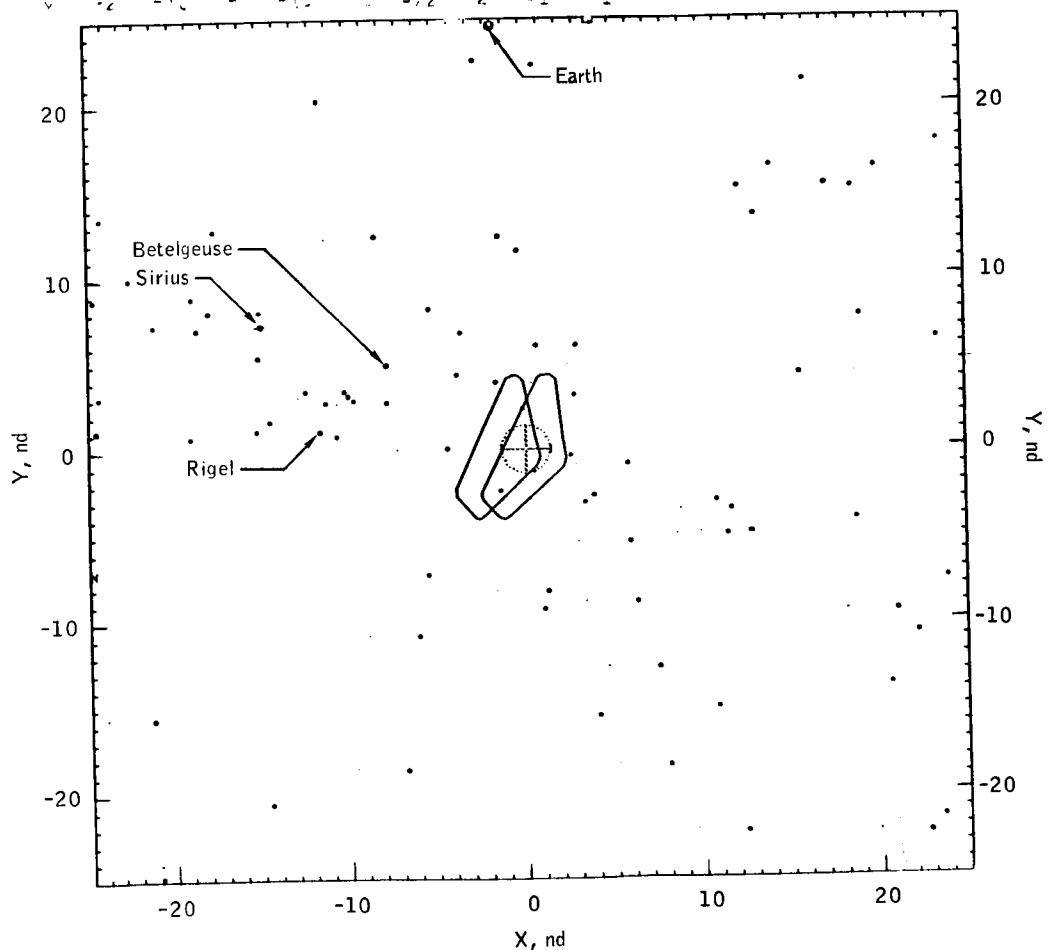


Figure 5. - Continued.

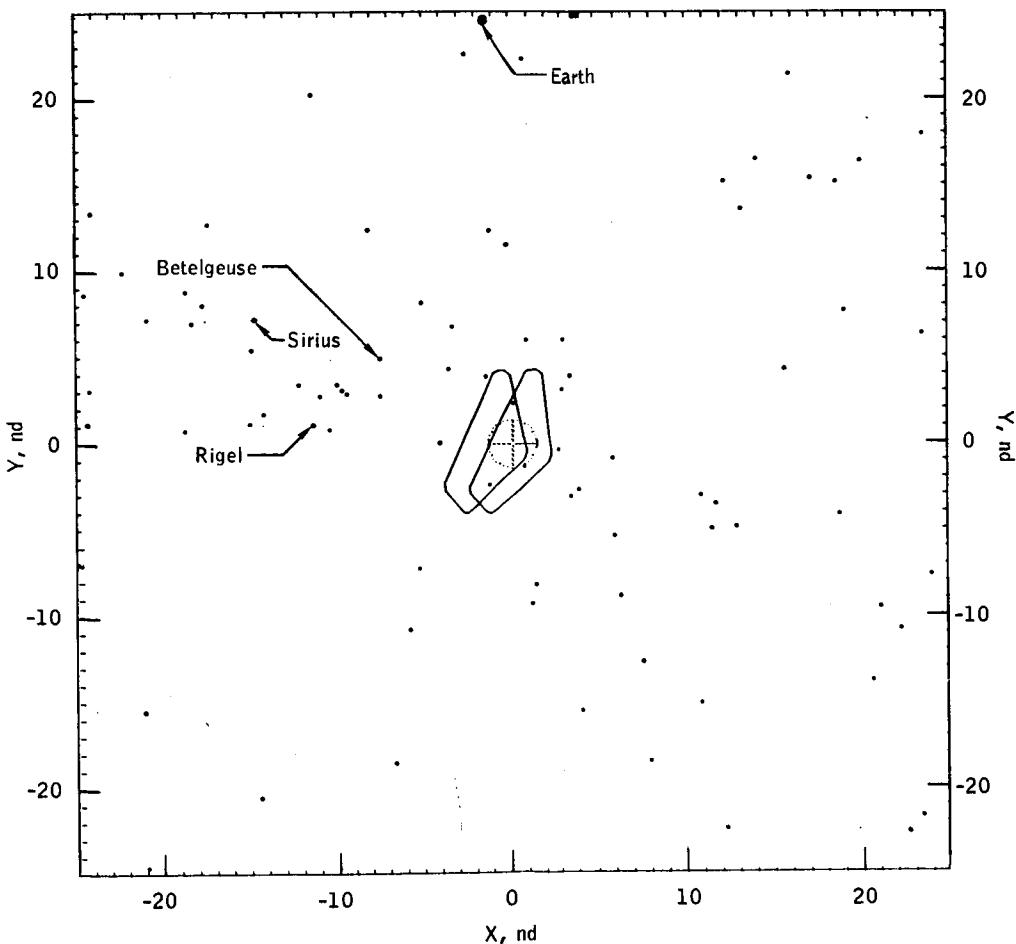
SEQ	1	5	7	15	22	25	31	41	47	53	63	70	73	75	80
X	-2	12	3	-14	11	-6	11	6	10	-21	7	15	5	1	-6
Y	-17	-4	-16	-22	-6	-10	-3	-8	-7	-15	-9	4	-5	-8	-10
Z	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SEQ	108	111	112	120	134	150	151	186	205	207	210	221	222	230	231
X	-5	3	3	5	-1	-2	2	-4	0	2	-10	-11	3	-7	-1
Y	-7	-7	-2	-2	-2	-1	0	0	2	3	-1	1	1	2	2
Z	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SEQ	273	287	279	245	243	244	251	252	256	265	270	271	281	291	292
X	-16	-29	-34	-11	-10	-5	-19	-10	-12	-7	2	-3	-15	-24	-24
Y	-1	1	2	3	3	4	0	3	3	5	6	6	5	6	1
Z	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SEQ	3-8	312	323	328	334	342	349	353	362	376	377	383	427	441	
X	-5	-15	-24	-18	-18	-21	-18	-10	-10	-11	-17	-17	-24	-24	-11
Y	8	7	3	7	8	7	9	11	12	12	12	12	13	13	8
Z	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SEQ	473	483	507	509	515	542	577	580	592	604	630	648	740	903	904
X	-1	0	-2	-12	-3	-13	-16	-15	-18	-19	-23	-18	-23	-23	-23
Y	-2	-2	-1	-13	-26	-16	-15	-21	-15	-16	-17	7	6	-7	-21
Z	-2	-10	-7	-13	-7	-22	-24	-14	-14	-18	-18	-18	-18	-18	-18



(a) 1 hour prior to LOI initiation.

Figure 6.- Star field and earth as observed prior to LOI.

SEQ	4	5	7	15	22	25	31	41	47	53	63	70	73	76	80	100
X	7	12	4	-14	11	-6	11	6	10	-21	1	15	5	1	-6	-5
Y	-12	-4	-15	-20	-4	-18	-3	-8	-2	-15	-9	4	-5	-8	-10	-7
SEQ	111	112	120	144	150	151	166	205	207	215	221	222	230	231	233	237
X	3	3	5	-1	0	2	-4	0	2	-10	-11	3	-7	-1	-15	-9
Y	-2	-2	0	-2	-1	0	0	2	3	1	1	4	2	4	1	3
SEQ	239	245	246	248	251	252	256	365	270	271	281	290	292	301	308	312
X	-14	-11	-9	-3	-18	-10	-12	-7	2	0	-3	-15	-24	-5	-14	-24
Y	1	2	3	4	0	3	3	5	6	6	6	5	1	8	7	3
SEQ	323	328	336	342	349	356	362	376	377	381	427	440	473	480	507	509
X	-18	-17	-21	-18	0	-8	-1	-22	-17	-24	-24	-11	-2	0	12	13
Y	7	8	7	9	11	12	12	10	12	8	13	20	22	22	15	13
SEQ	615	540	577	580	592	604	639	658	740	903	904	907	931	942	950	971
X	3	14	17	15	18	19	23	18	23	23	23	22	22	21	20	18
Y	25	16	15	21	15	16	18	7	6	-7	-21	-22	-10	-9	-13	-3
SEQ	984	1010	1044	1046												
X	12	-21	10	7												
Y	-22	-24	-14	-18												



(b) 30 minutes prior to LOI initiation.

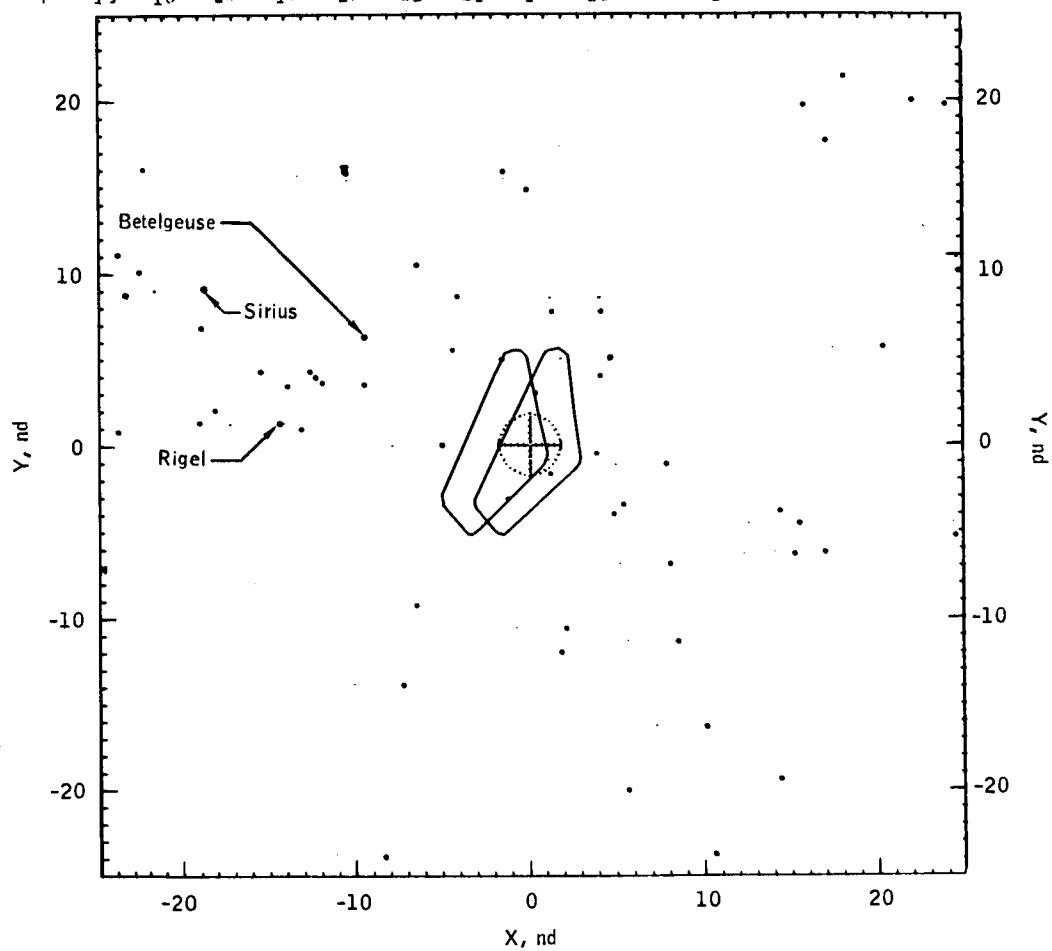
Figure 6.- Continued.

SEG	4	5	7	22	25	31	41	47	63	70	73	75	80	108	111	112
X	-10	16	-5	15	-8	15	0	14	1	20	0	2	-7	-6	-4	5
Y	-14	-6	-19	-6	-23	-4	-11	-3	-11	5	-4	-10	-13	-9	-3	-3

SEG	120	144	150	151	186	205	207	215	221	222	230	231	233	237	239	245
X	7	-1	1	3	-5	0	4	-13	-14	4	-9	-1	-19	-12	-18	-14
Y	0	-2	-1	0	0	3	4	1	1	5	3	5	1	3	2	3

SEG	246	248	251	252	256	265	270	271	281	290	301	308	323	328	342	349
X	-12	-4	-23	-12	-15	-9	4	1	-4	-19	-6	-18	-23	-22	-23	0
Y	4	5	1	4	4	6	7	7	8	7	10	9	8	10	11	14

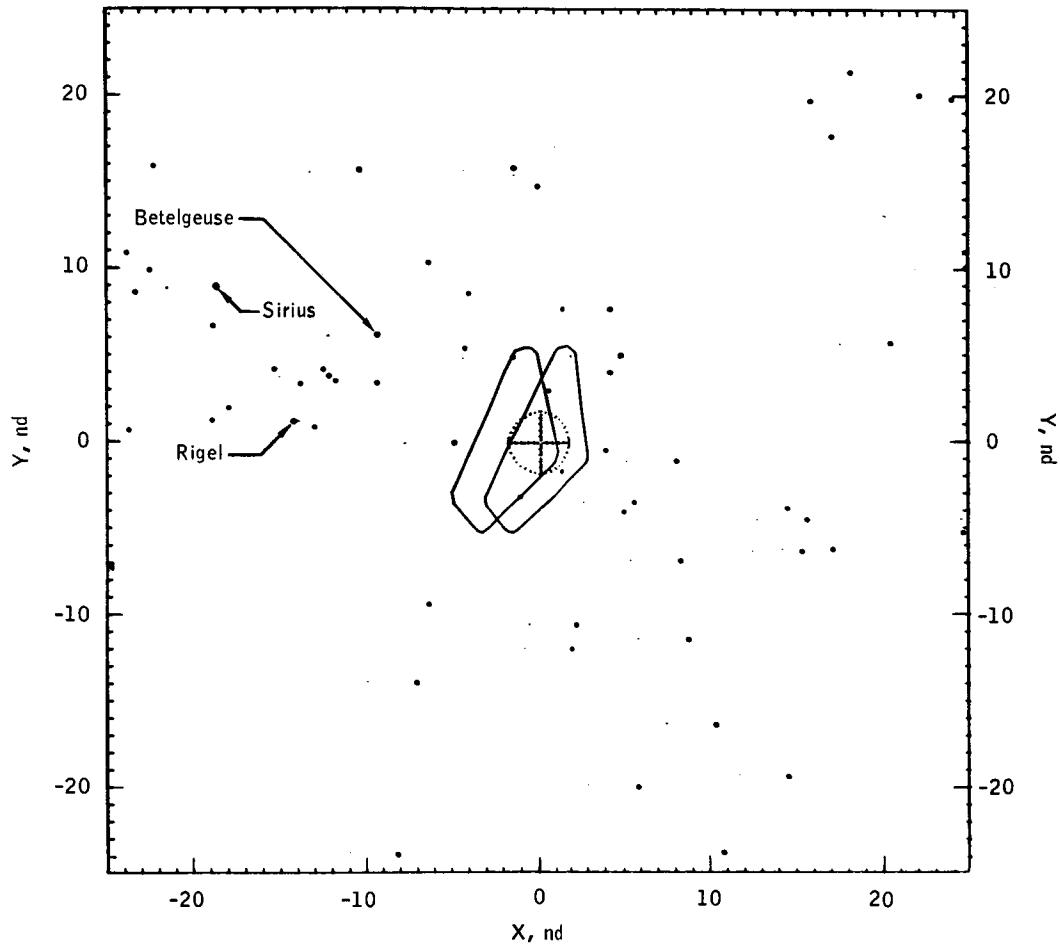
SEG	356	362	377	507	509	540	577	592	658	971	1044	1046
X	-10	-1	-22	15	17	18	22	23	24	24	14	10
Y	15	16	16	19	17	21	20	19	10	-5	-19	-23



(c) 14 minutes prior to LOI initiation.

Figure 6.- Continued.

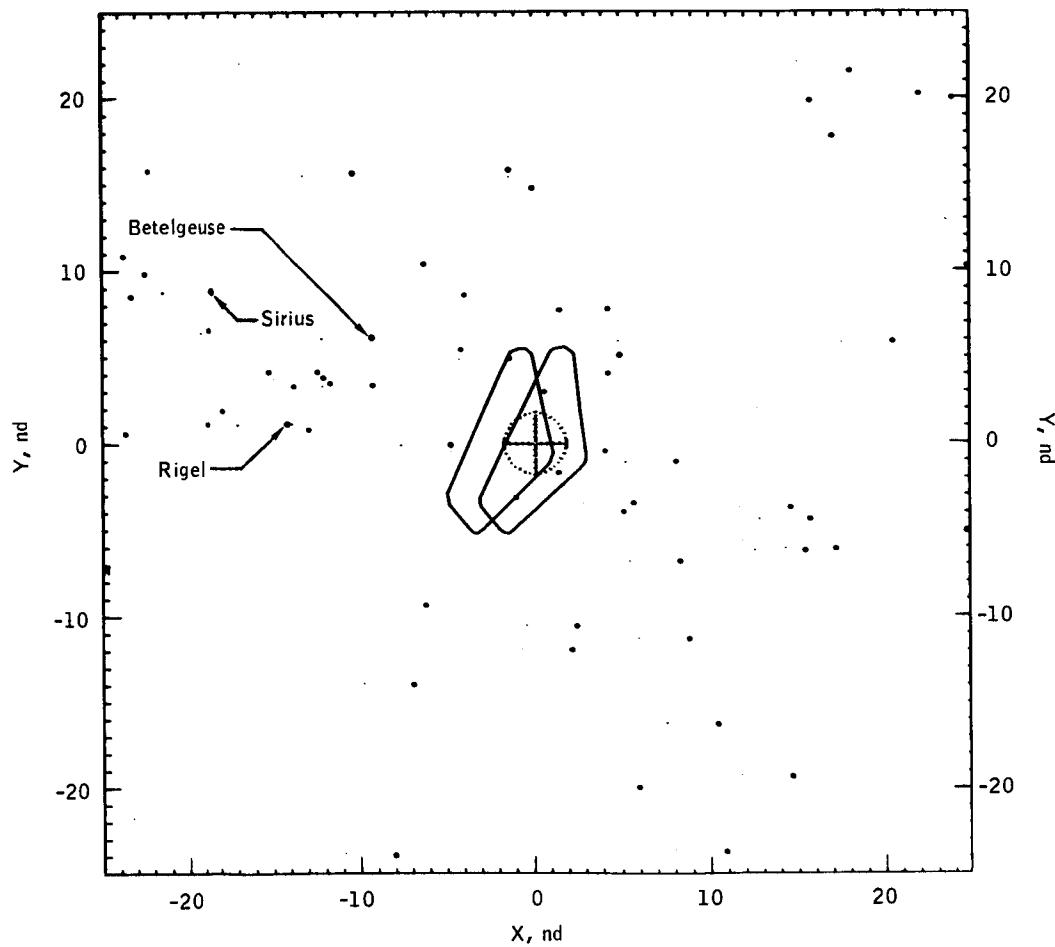
SEQ	4	5	7	22	25	31	41	47	63	70	73	75	80	108	111	112
X	10	17	5	15	-8	13	8	14	1	20	8	2	7	-6	4	5
Y	-16	-5	-19	-6	-23	-4	-11	-3	-11	5	-6	-10	-13	-9	-3	-3
SEQ	120	144	150	151	186	205	207	215	221	222	230	231	233	237	239	245
X	7	-1	1	3	=4	0	4	-13	-14	4	-9	-1	-19	-11	-18	-13
Y	0	-2	-1	0	0	3	4	1	1	5	3	5	1	3	2	3
SEQ	246	248	251	252	256	265	270	271	281	290	301	308	323	328	342	349
X	-12	-4	-23	-12	-15	-9	4	1	-4	-18	-6	-18	-23	-22	-23	0
Y	4	5	0	4	4	6	7	7	8	6	10	9	8	10	11	14
SEQ	356	362	377	507	509	540	577	592	658	971	1044	1046				
X	-10	-1	-22	15	16	18	22	23	24	24	14	10				
Y	15	16	18	19	17	21	20	20	10	-4	-19	-23				



(d) 10 minutes prior to LOI initiation.

Figure 6.- Continued.

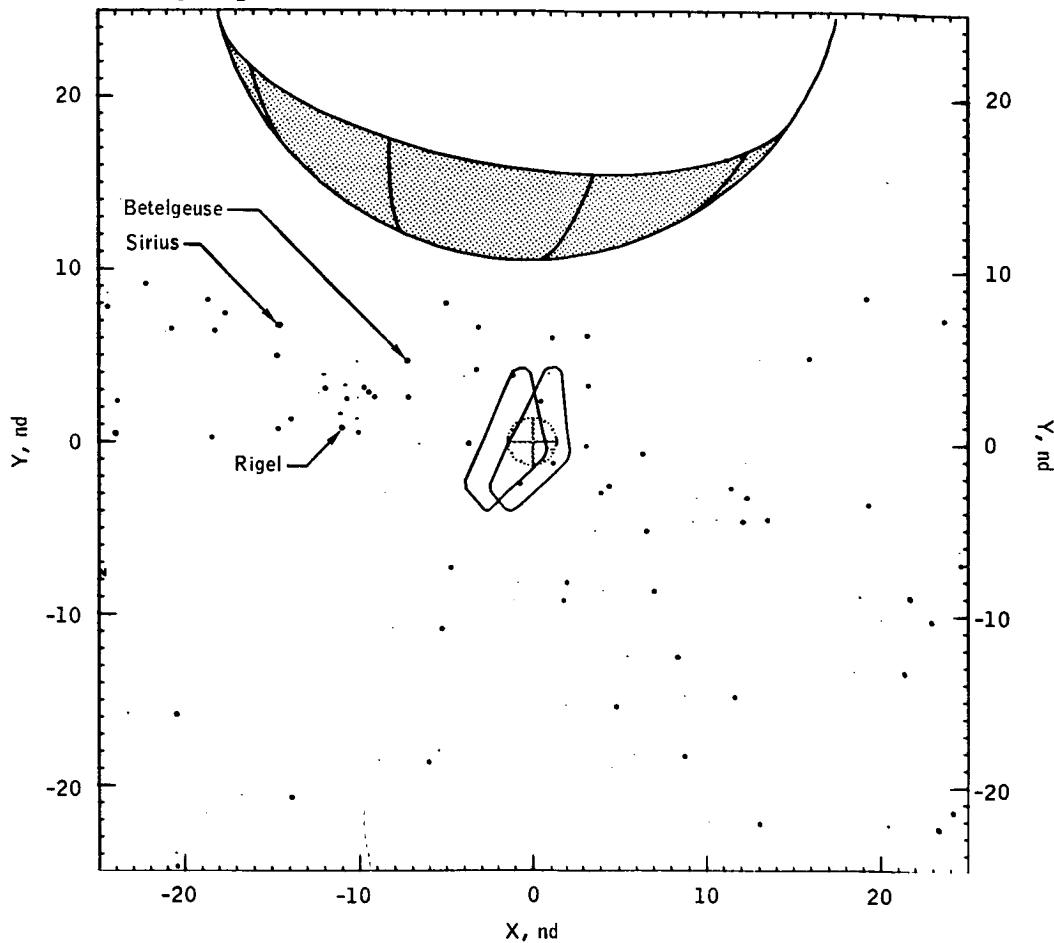
SEG	4	5	7	22	25	31	41	47	63	70	73	75	80	108	111	112
X	-16	-5	-19	-6	-23	-4	-11	-14	-2	20	8	2	-7	-6	-5	-5
Y	-16	-5	-19	-6	-23	-4	-11	-13	-11	6	-6	-10	-13	-9	-3	-3
SEG	120	144	150	151	186	205	207	215	221	222	230	231	233	237	239	245
X	8	-1	1	3	-4	0	4	-13	-14	4	-9	-1	-18	-11	-18	-13
Y	0	-2	-1	0	0	3	4	1	1	5	3	5	1	3	2	3
SEG	246	248	251	252	256	265	270	271	281	290	301	308	323	328	342	349
X	-12	-4	-23	-12	-15	-9	4	1	-4	-18	-6	-18	-23	-22	-23	0
Y	4	5	0	4	4	6	7	7	8	6	10	9	8	10	11	14
SEG	356	362	377	507	509	540	577	592	658	971	1044	1046				
X	-16	=1	-22	15	16	18	21	23	24	24	14	10				
Y	15	16	16	20	17	21	20	20	10	-4	-19	-23				



(e) 8 minutes prior to LOI initiation.

Figure 6.- Continued.

SEG	4	5	7	15	22	25	31	41	47	53	63	70	73	75	80	108
X	9	13	4	-13	12	-6	12	7	11	-20	1	15	6	2	-5	-4
Y	-12	-4	-15	-20	-4	-18	-3	-8	-2	-15	-9	5	-5	-8	-10	-7
SEG	111	112	120	144	150	151	186	203	207	215	221	222	230	231	233	237
X	4	4	6	0	1	3	3	0	3	-10	-11	3	-7	-1	-14	-9
Y	-2	-2	0	-2	-1	0	0	2	3	2	0	4	2	4	0	2
SEG	239	245	246	248	251	252	256	265	270	271	281	290	292	301	308	312
X	-13	-10	-9	-5	-18	-9	-11	-7	3	1	-3	-14	-24	-5	-14	-23
Y	1	2	3	4	0	3	3	4	6	6	5	0	8	6	2	
SEG	323	328	336	342	376	381	658	740	903	904	907	931	942	950	971	984
X	-18	-17	-20	-18	-22	-24	19	23	24	24	23	22	21	21	19	13
Y	6	7	6	5	9	7	7	7	-6	-21	-22	-10	-8	-13	-3	-22
SFG	1010	1044	1046													
X	-20	11	8													
Y	-24	-14	-19													



(f) 2 minutes prior to LOI initiation.

Figure 6.- Concluded.

SEQ	4	5	22	31	41	47	63	73	75	80	108	111	112
X	15	24	21	22	12	20	3	11	3	-9	-8	7	8
Y	-22	-7	-8	-5	-15	-4	-16	-9	-14	-19	-13	-5	-4

SEG	120	144	150	151	186	205	207	215	221	222	230	231
X	11	-1	2	5	-6	0	5	-18	-19	6	-13	-2
Y	-1	-4	-2	0	0	4	5	0	1	7	4	7

SEQ	237	245	246	248	252	256	265	270	271	281
X	-16	-19	-17	-5	-17	-21	-13	5	1	-5
Y	4	4	5	7	5	5	8	11	11	12

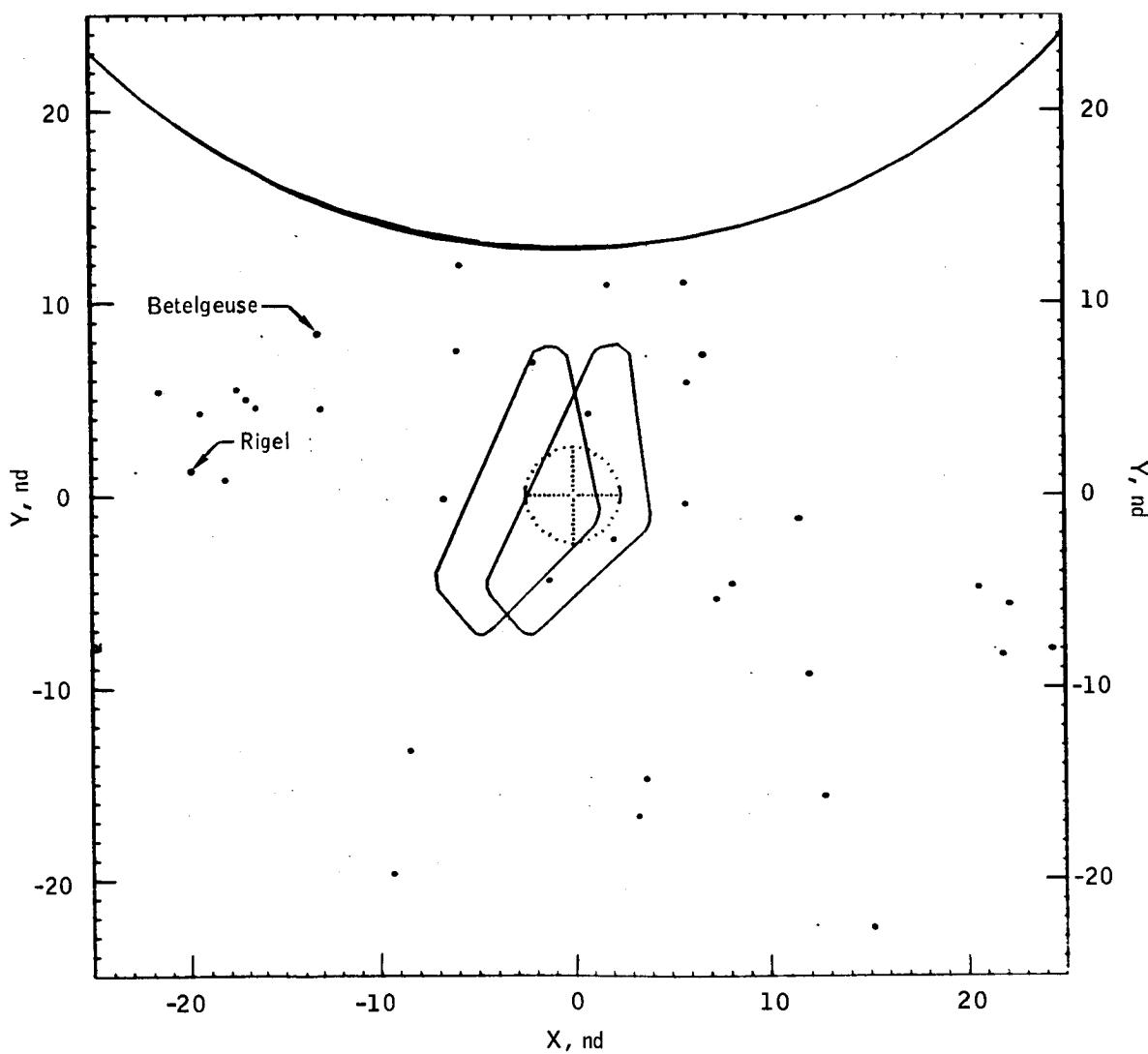


Figure 7a..- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
Beginning of L01 burn.

SEQ	4	22	31	41	47	63	73	75	80	108	111	112	120
X	15	22	22	13	21	4	12	4	-8	-7	8	8	12
Y	-22	-7	-5	-15	-4	-16	-8	-14	-19	-12	-5	-4	0

SEQ	144	150	151	186	205	207	215	221	222	230	231	237
X	0	2	6	-6	1	6	-17	-19	7	-12	-1	-15
Y	-4	-2	0	0	4	6	0	1	7	4	7	4

SEQ	239	245	246	248	252	256	265
X	-24	-18	-16	-5	-16	-20	-12
Y	2	4	5	7	5	5	8

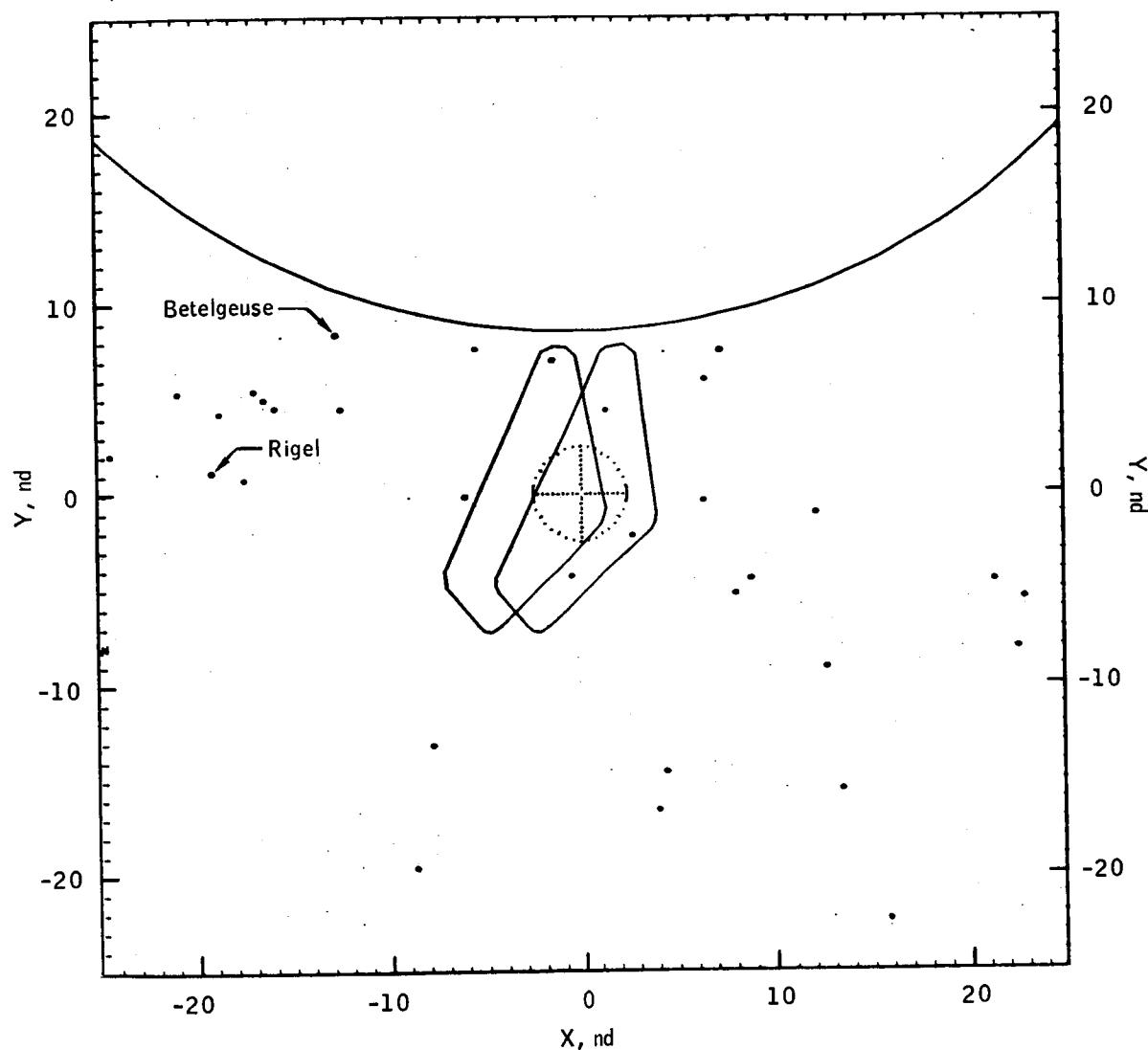


Figure 7b.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
Middle of LOI burn.

SEQ	4	22	31	41	47	63	73	75	80	108	111	112	120
X	17	24	24	15	23	5	14	6	-6	-5	9	10	13
Y	-21	-7	-4	-14	-3	-15	-8	-14	-19	-12	-4	-3	0

SEG	144	150	151	186	215	221	230	233	237	239	245	246
X	1	4	8	-4	-15	-17	-10	-23	-14	-22	-17	-14
Y	-3	-1	0	0	1	1	4	1	4	2	4	5

SEQ 256
X -19
Y 5

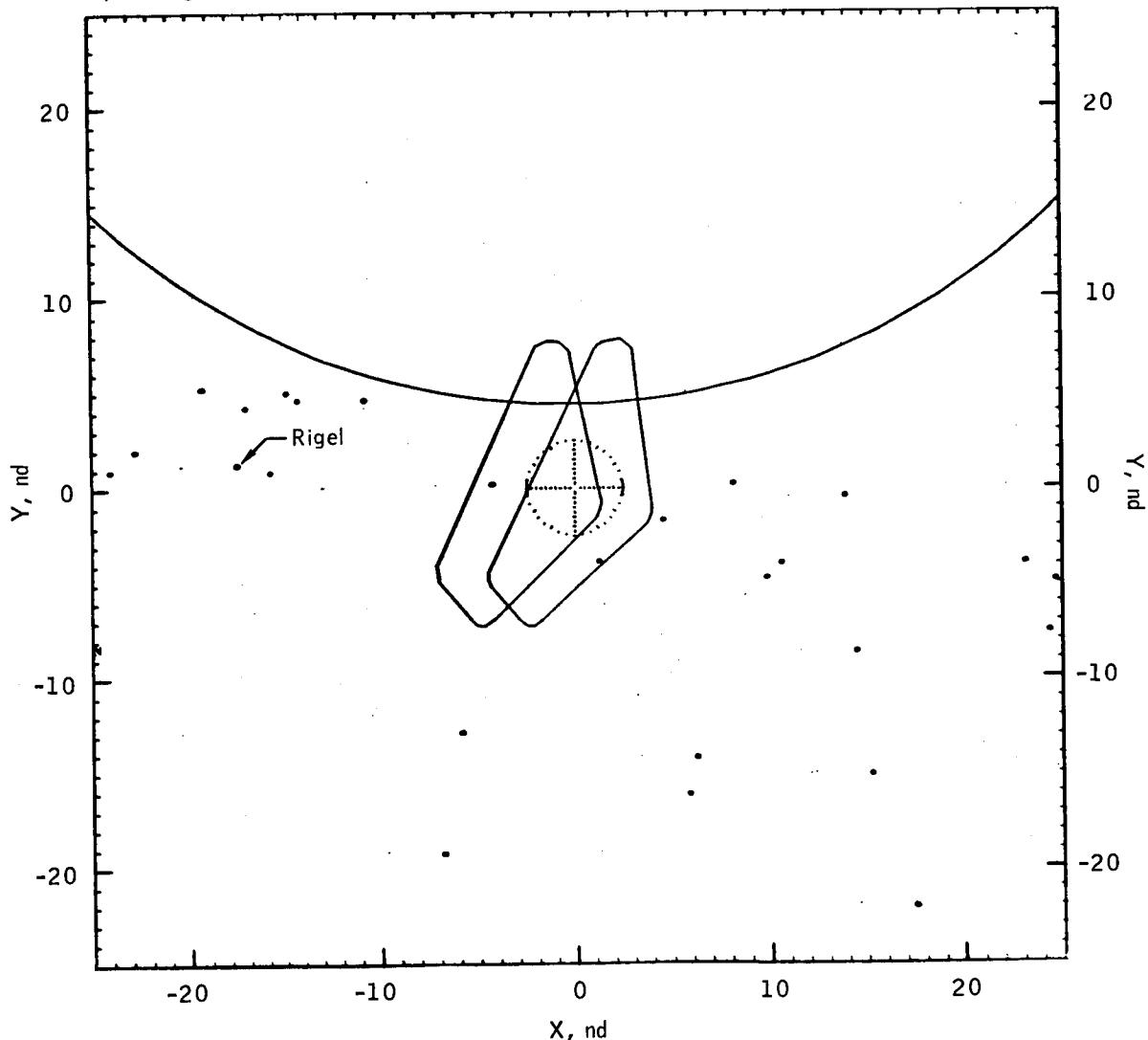


Figure 7c.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
End of LOI burn.

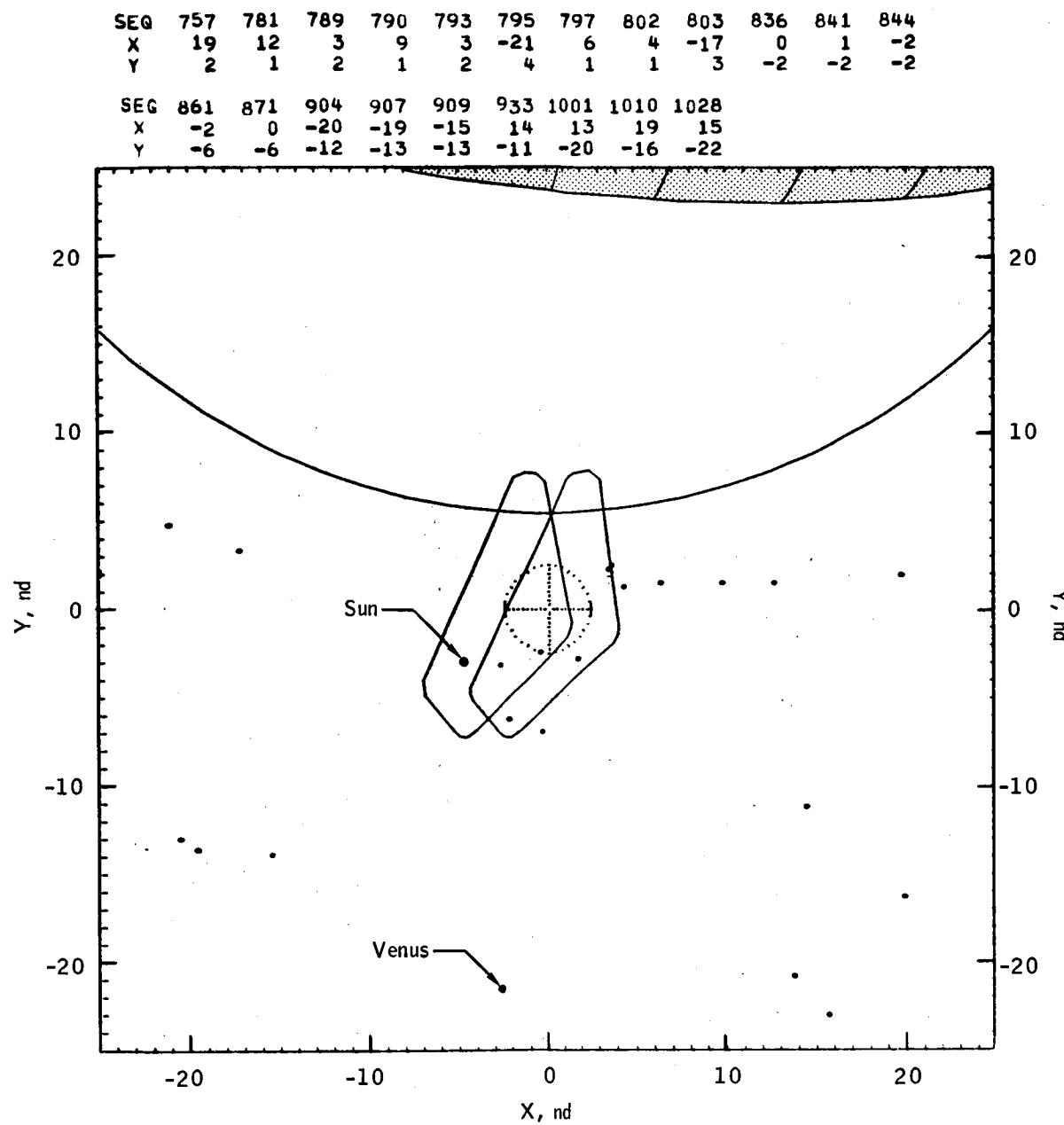


Figure 8a. - Launch date December 21, 1968; 72° launch azimuth; first opportunity.
Begining of TEI burn.

SEQ	757	759	770	781	789	790	793	795	797	802	803	836	841
X	19	2	-6	12	3	9	3	-21	6	4	-17	0	1
Y	1	6	6	1	2	1	2	4	1	1	3	-2	-2

SEG	844	861	871	904	907	909	933	1001	1010	1028
X	-2	-2	0	-20	-19	-15	14	13	19	15
Y	-3	-6	-6	-12	-13	-13	-11	-20	-16	-22

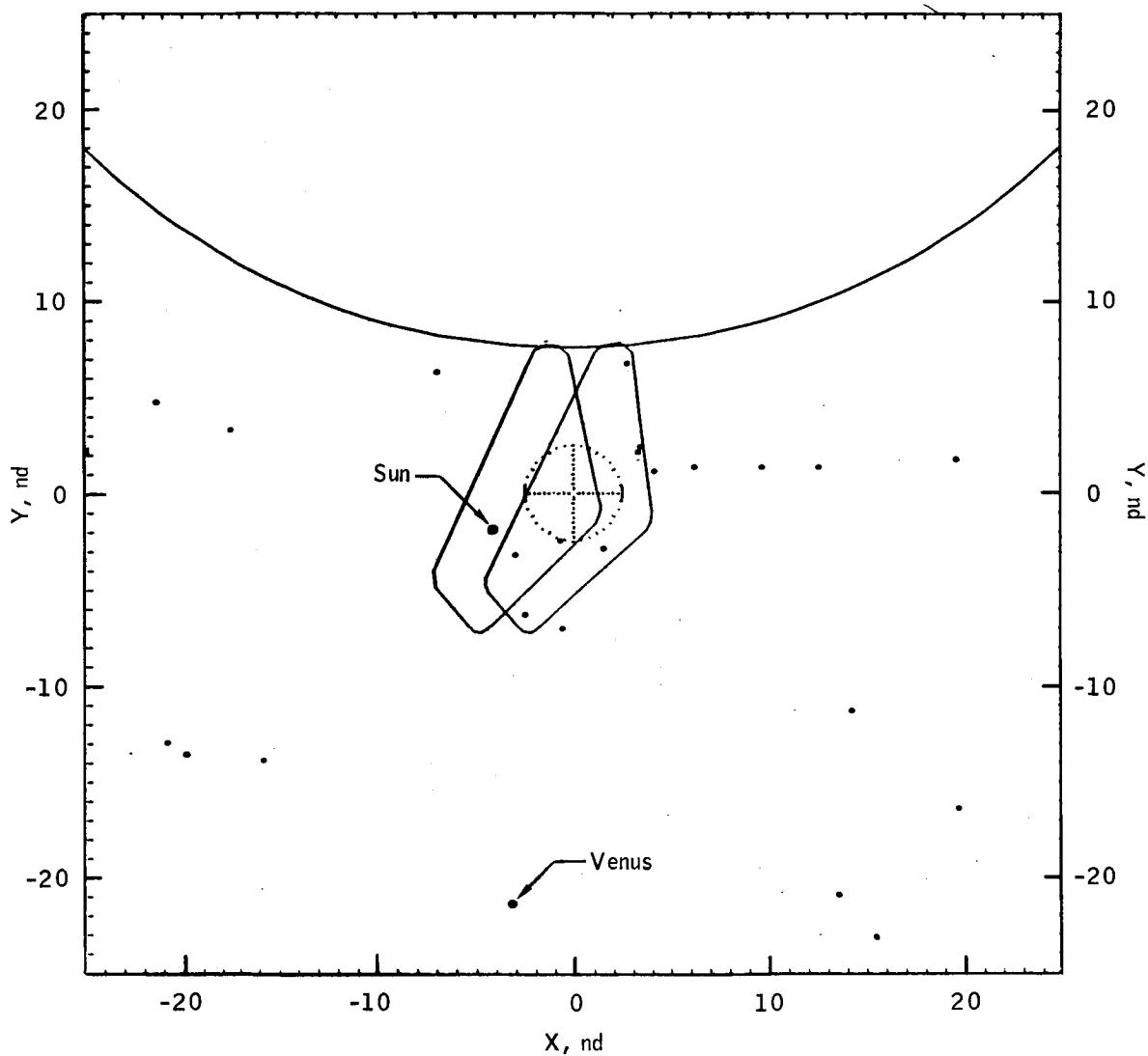


Figure 8b.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
Middle of TEI burn.

SEQ	643	736	743	751	753	757	759	770	781	789	790	793	795
X	19	-1	0	0	-8	19	2	-7	12	3	9	2	-21
Y	10	10	9	9	10	1	6	6	1	2	1	2	4

SEQ	797	802	803	836	841	844	861	871	904	907	909	933
X	5	3	-17	-1	1	-3	-2	-1	-21	-20	-16	13
Y	1	1	3	-2	-2	-3	-6	-6	+12	-13	-13	-11

SEQ 1001 1010 1028

X	13	19	15
Y	-20	-16	-23

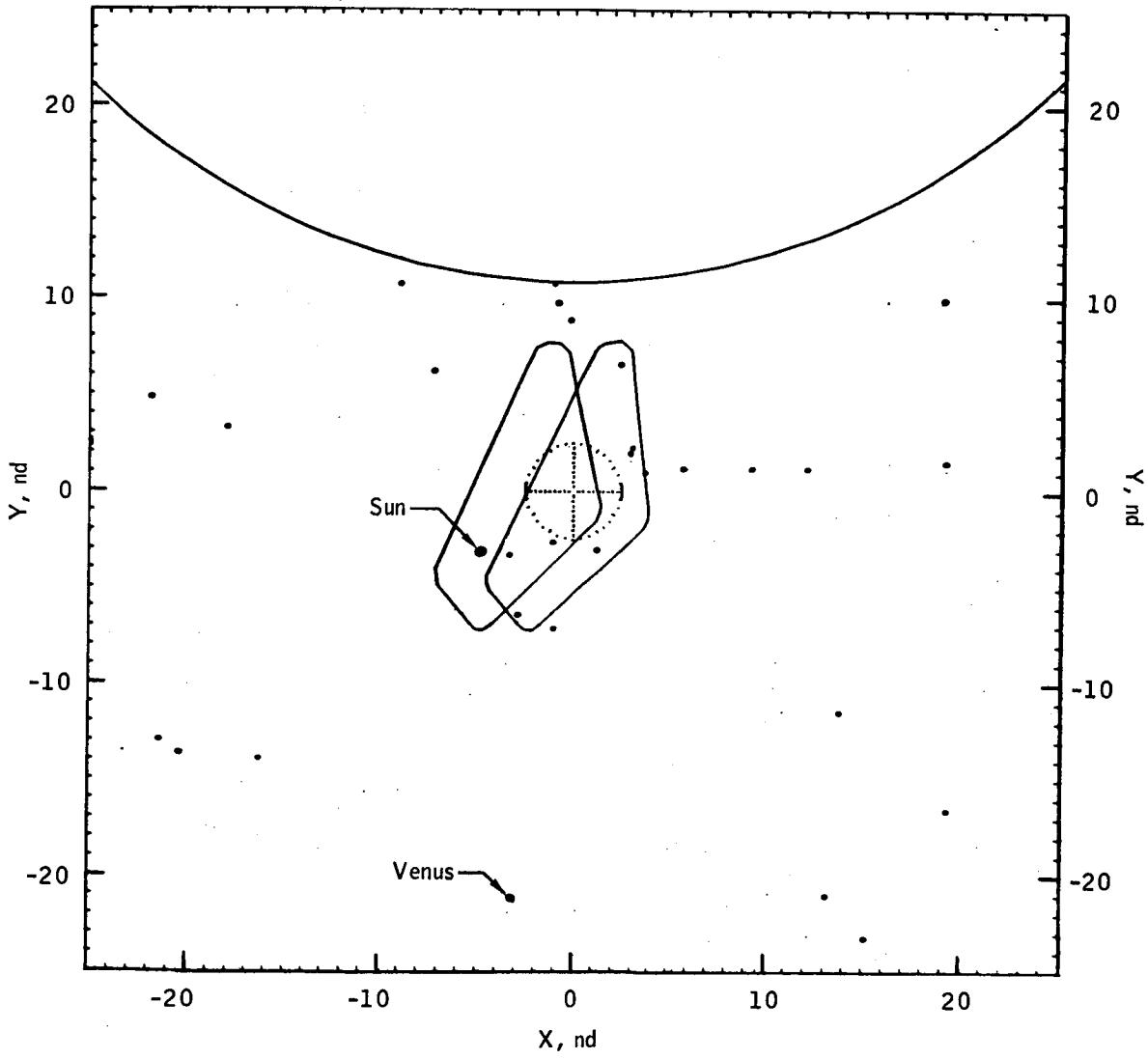
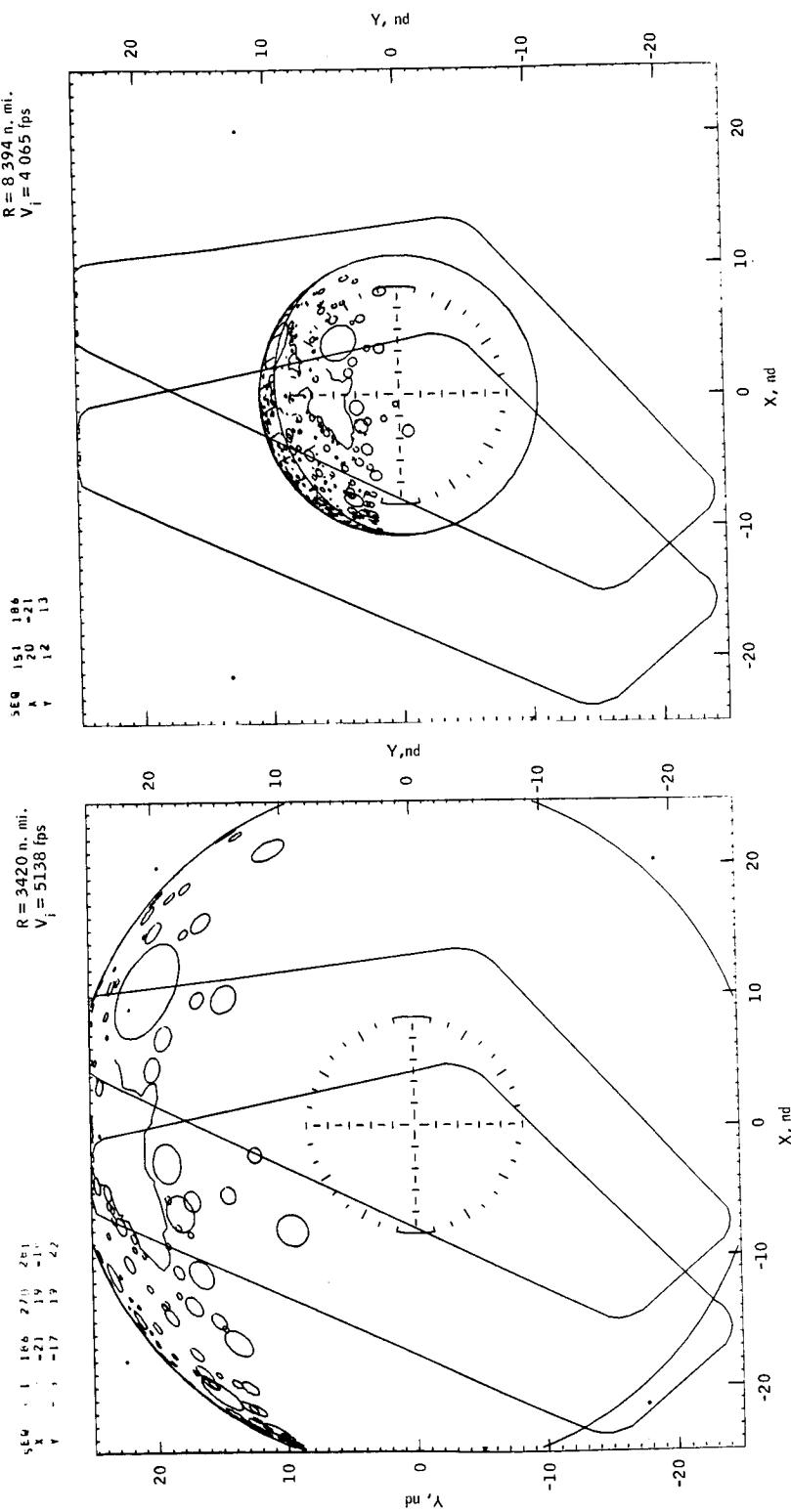


Figure 8c.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
End of TE1 burn.

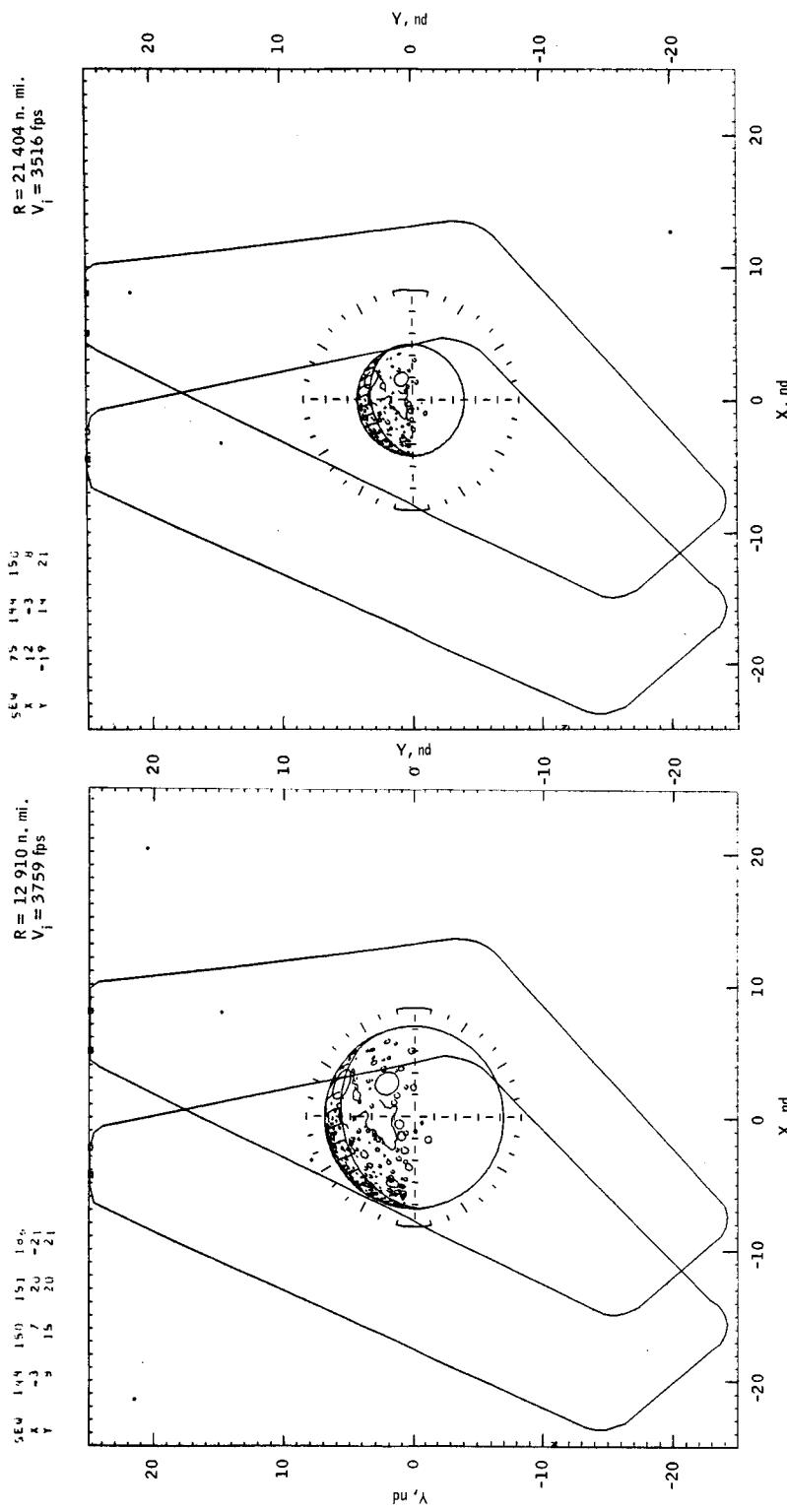


(a) Time from TEI cutoff = 1 hr.

Figure 9.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
Transearth coast (moon referenced).

(b) Time from TEI cutoff = 3 hr.

Figure 9.- Continued.

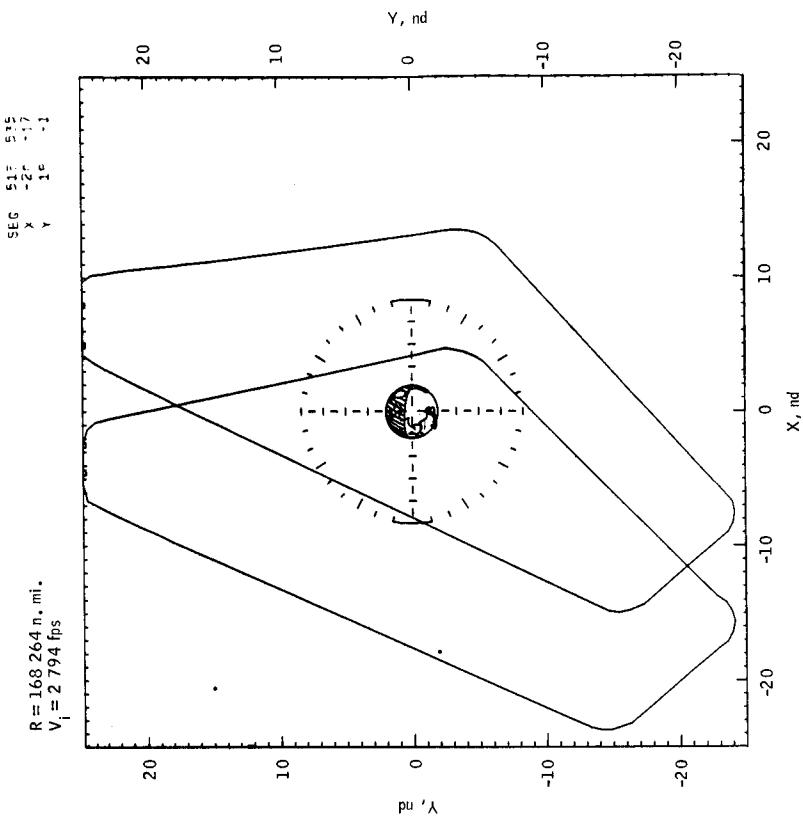


(c) Time from TEI cutoff = 5 hr.

(d) Time from TEI cutoff = 9 hr.

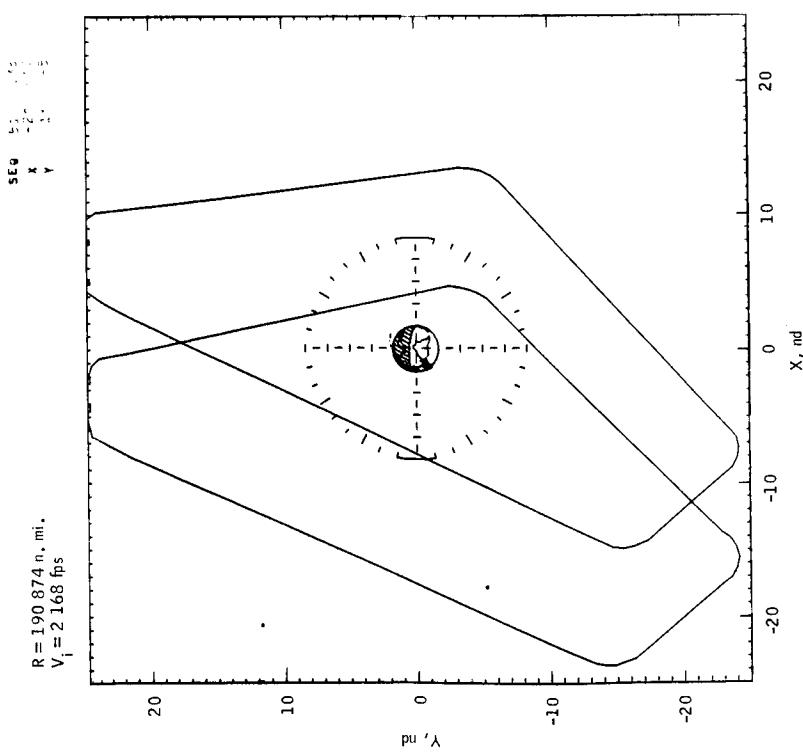
Figure 9.- Continued.

Figure 9.- Concluded.



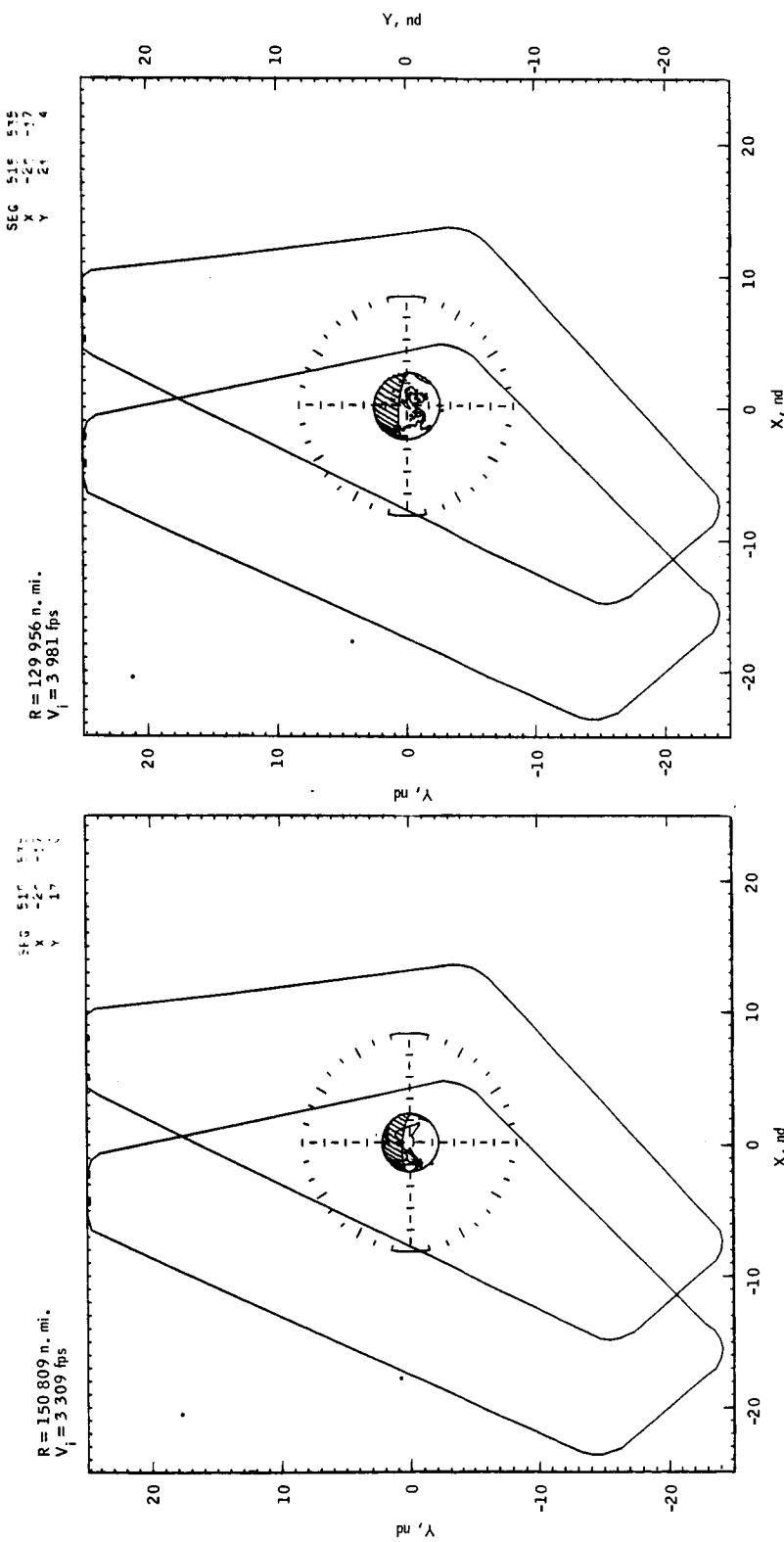
(b) Time from TEI cutoff = 30 hr.

Figure 10.-Continued.



(a) Time from TEI cutoff = 14 hr.

Figure 10.- Launch date December 21, 1968; 72° launch azimuth; first opportunity.
 Transearth coast.



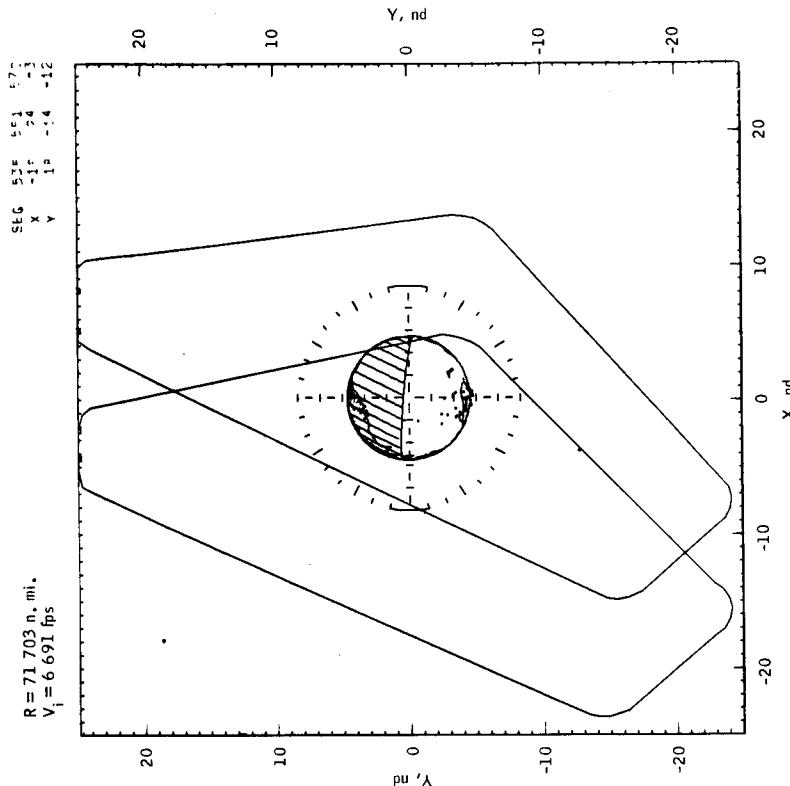
(c) Time from TEI cutoff = 40 hr.

Figure 10. - Continued.

(d) Time from TEI cutoff = 50 hr.

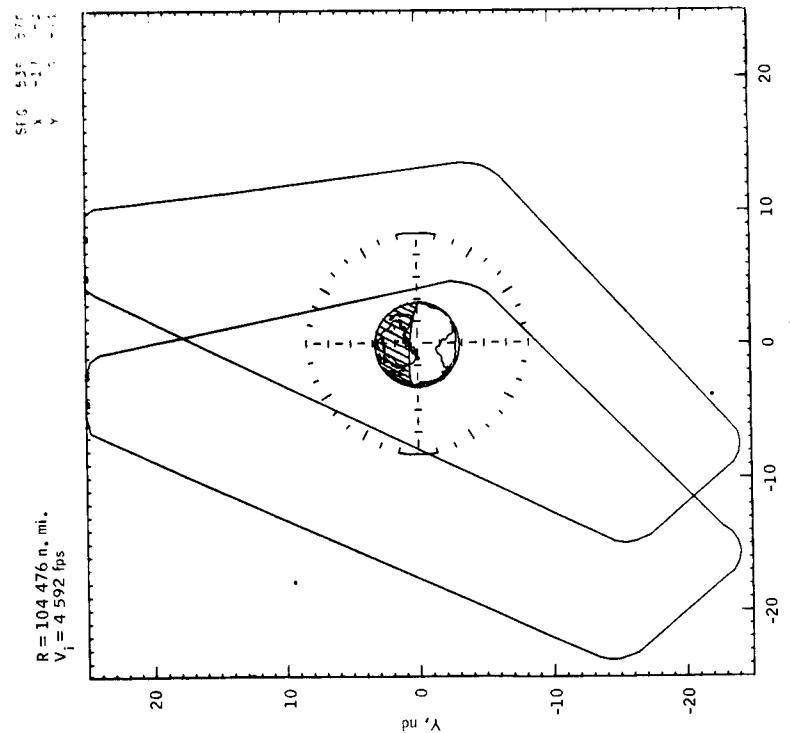
Figure 10. - Continued.

50



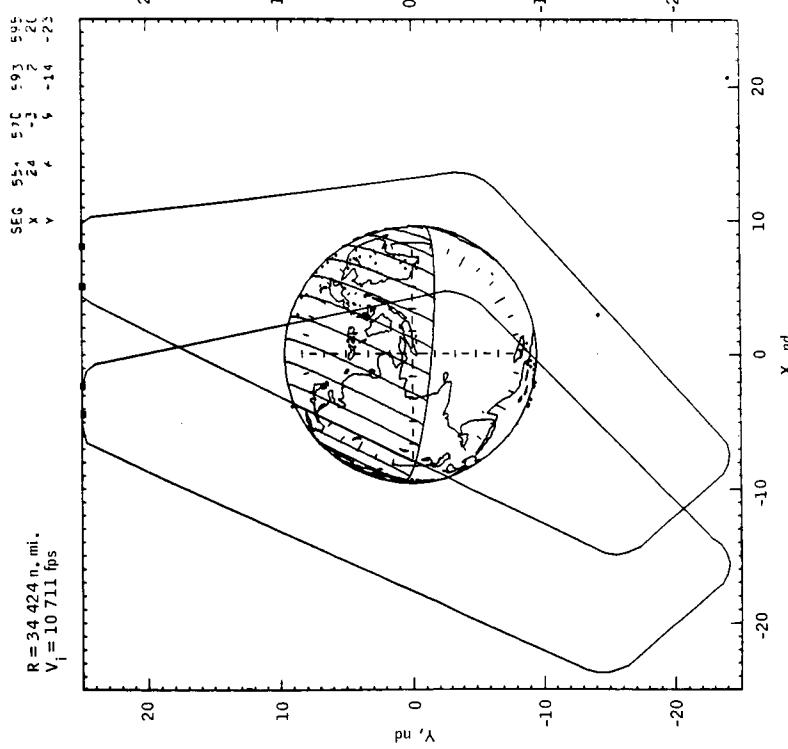
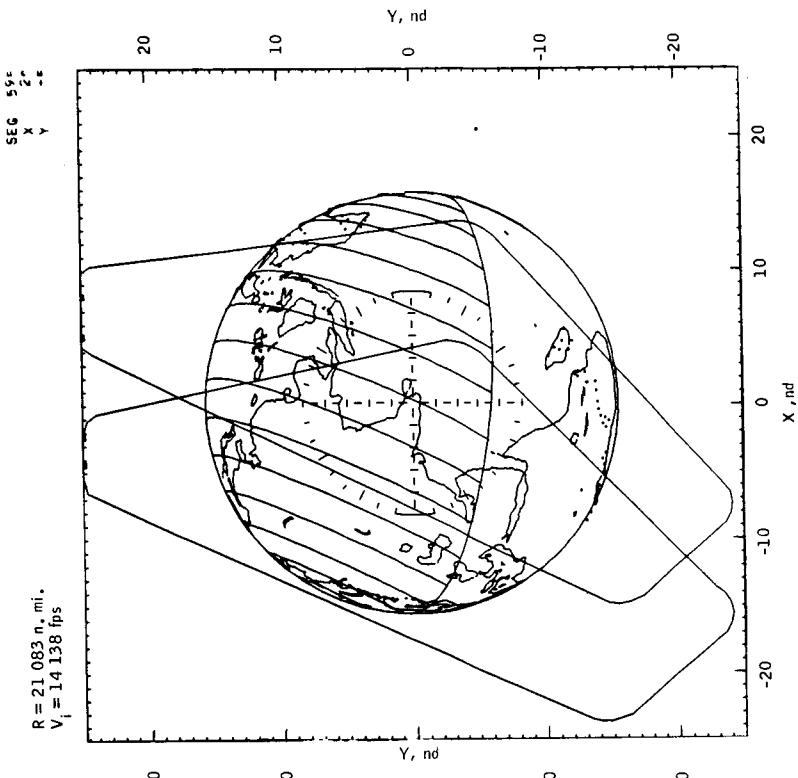
(e) Time from TEI cutoff = 60 hr.

Figure 10.- Continued.



(f) Time from TEI cutoff = 70 hr.

Figure 10.- Continued.



(g) Time from TEI cutoff = 78 hr.

Figure 10.- Continued.

(h) Time from TEI cutoff = 80 hr.

Figure 10.- Concluded.

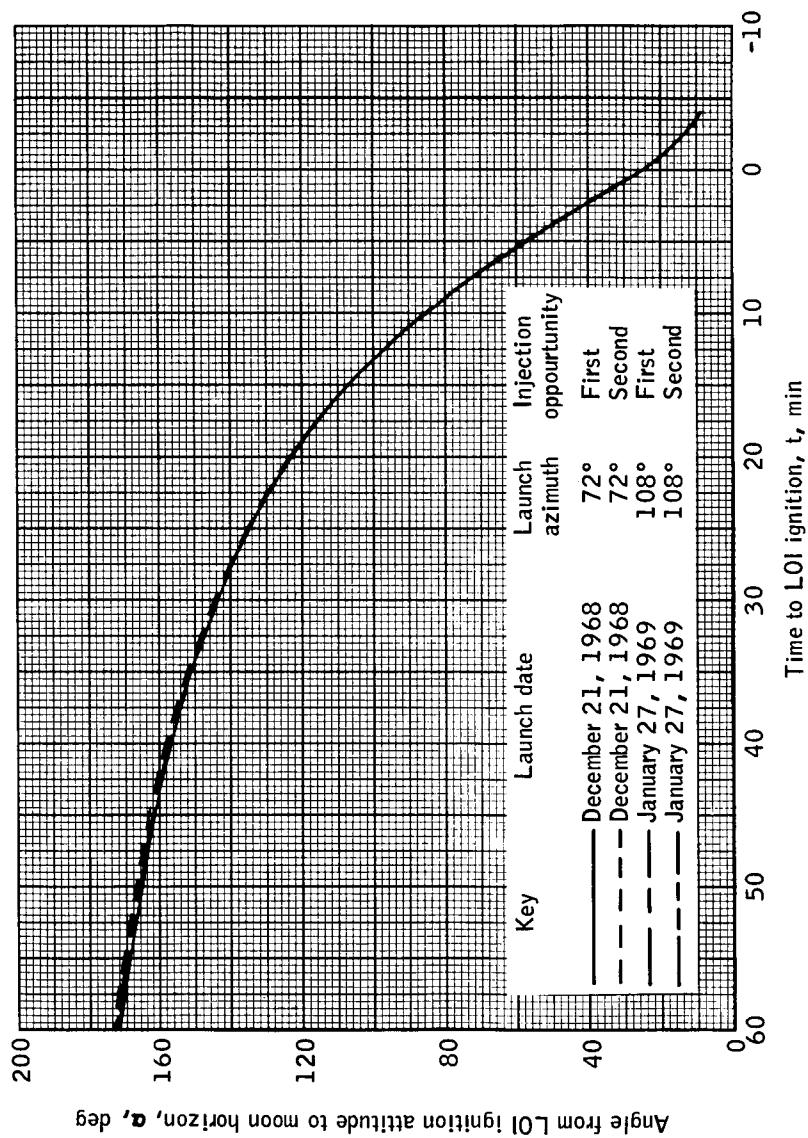


Figure 11. - Angle from L0I ignition attitude to moon horizon as a function of time to L0I ignition.

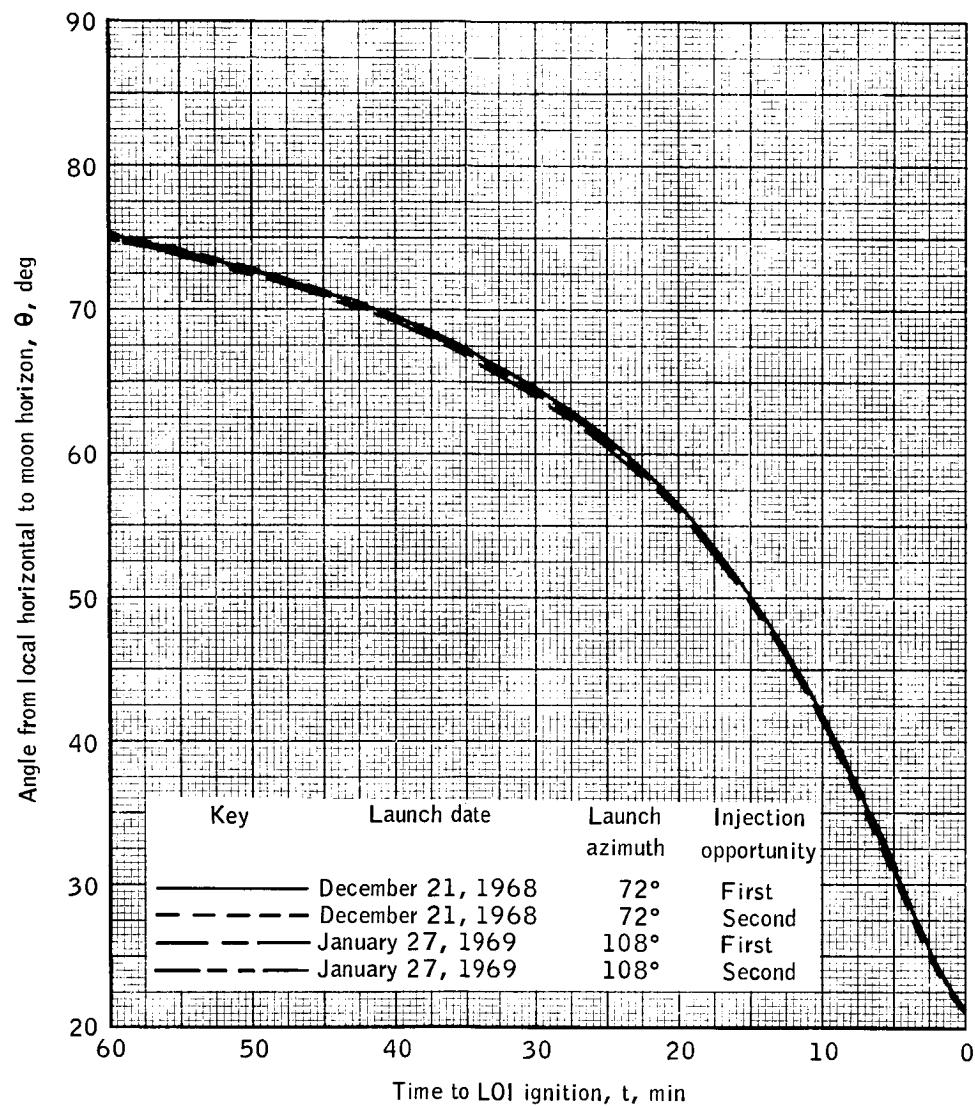


Figure 12.- Angle from local horizontal to moon horizon as a function of time to LOI ignition.

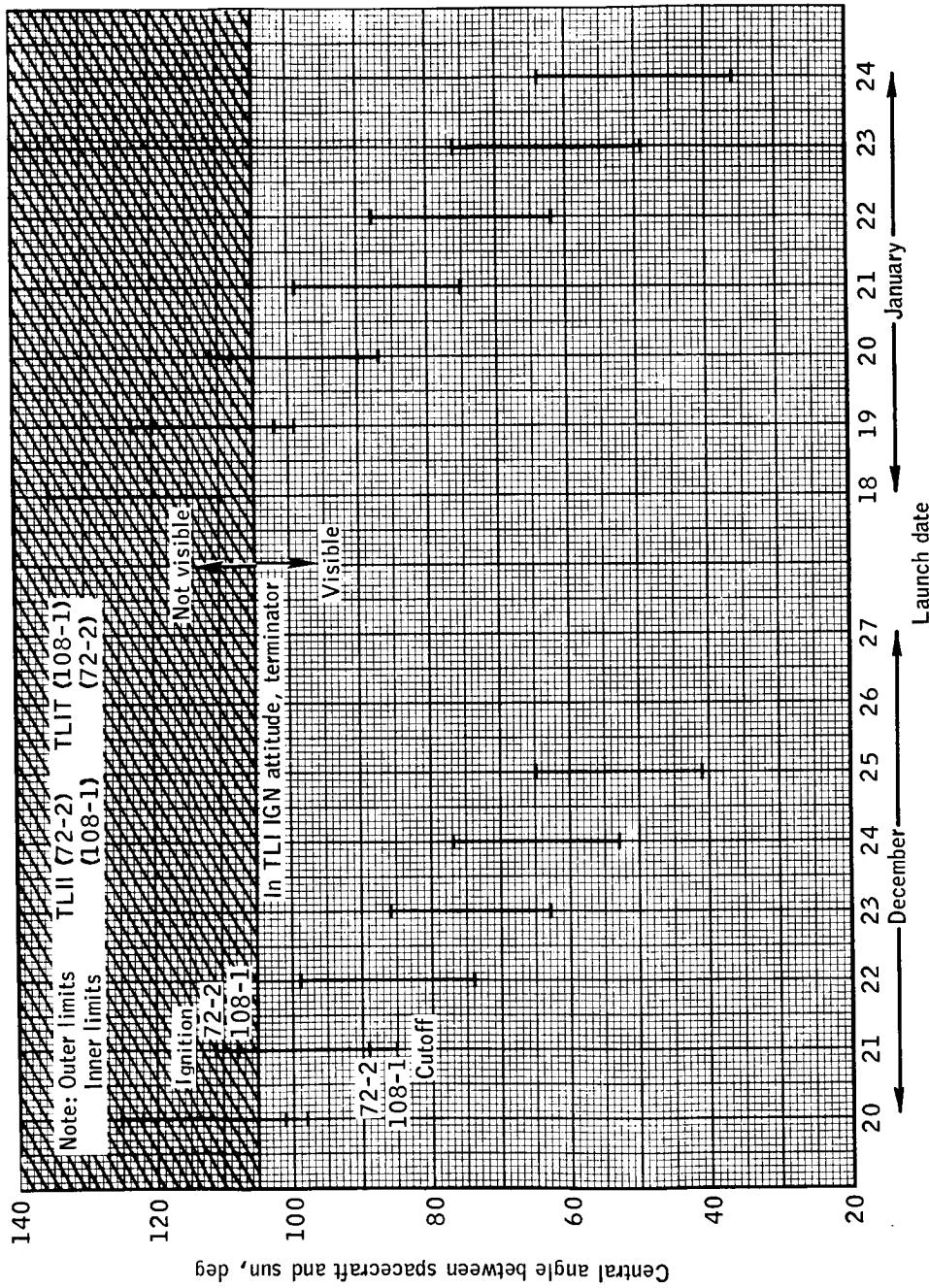
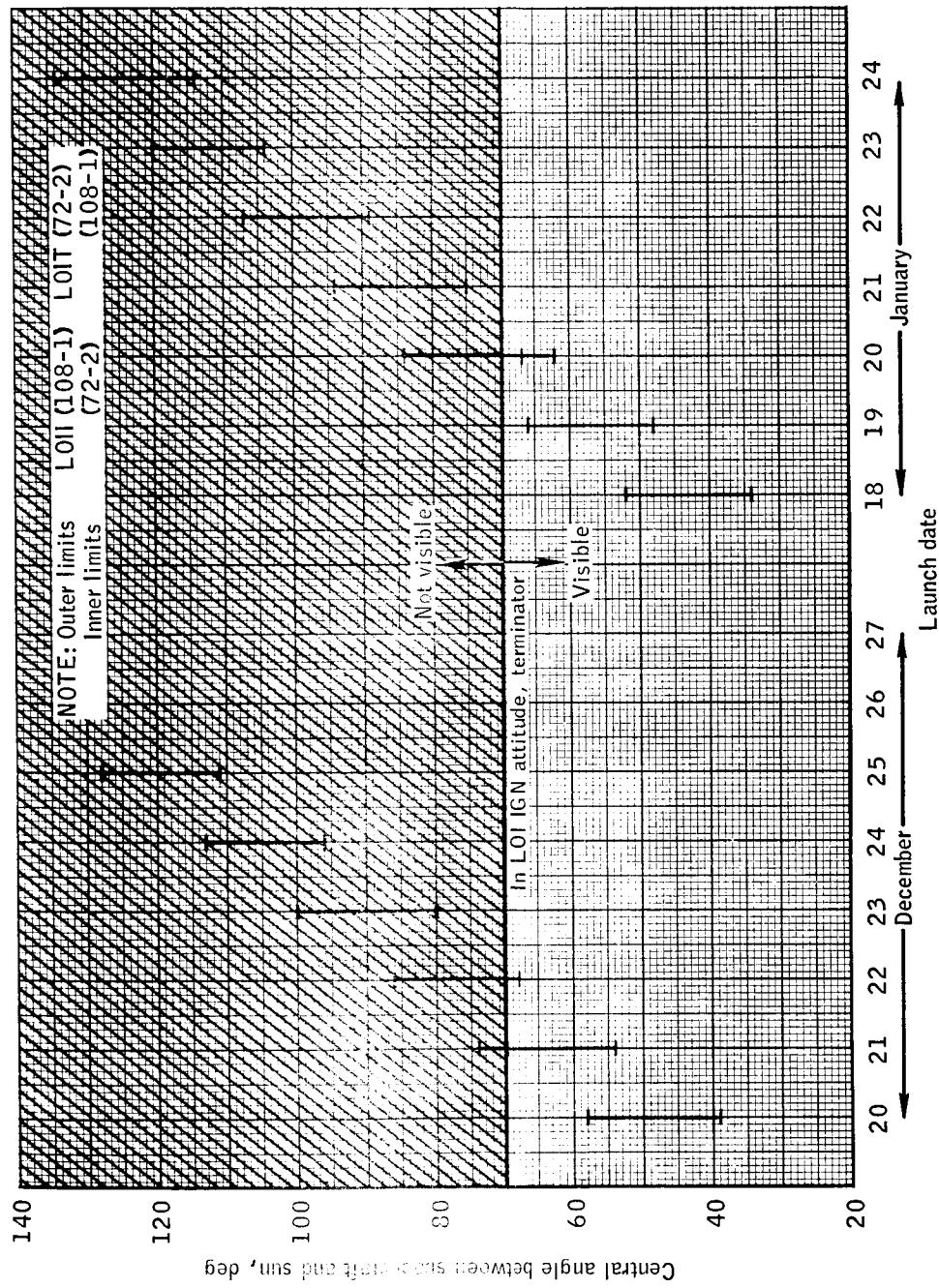
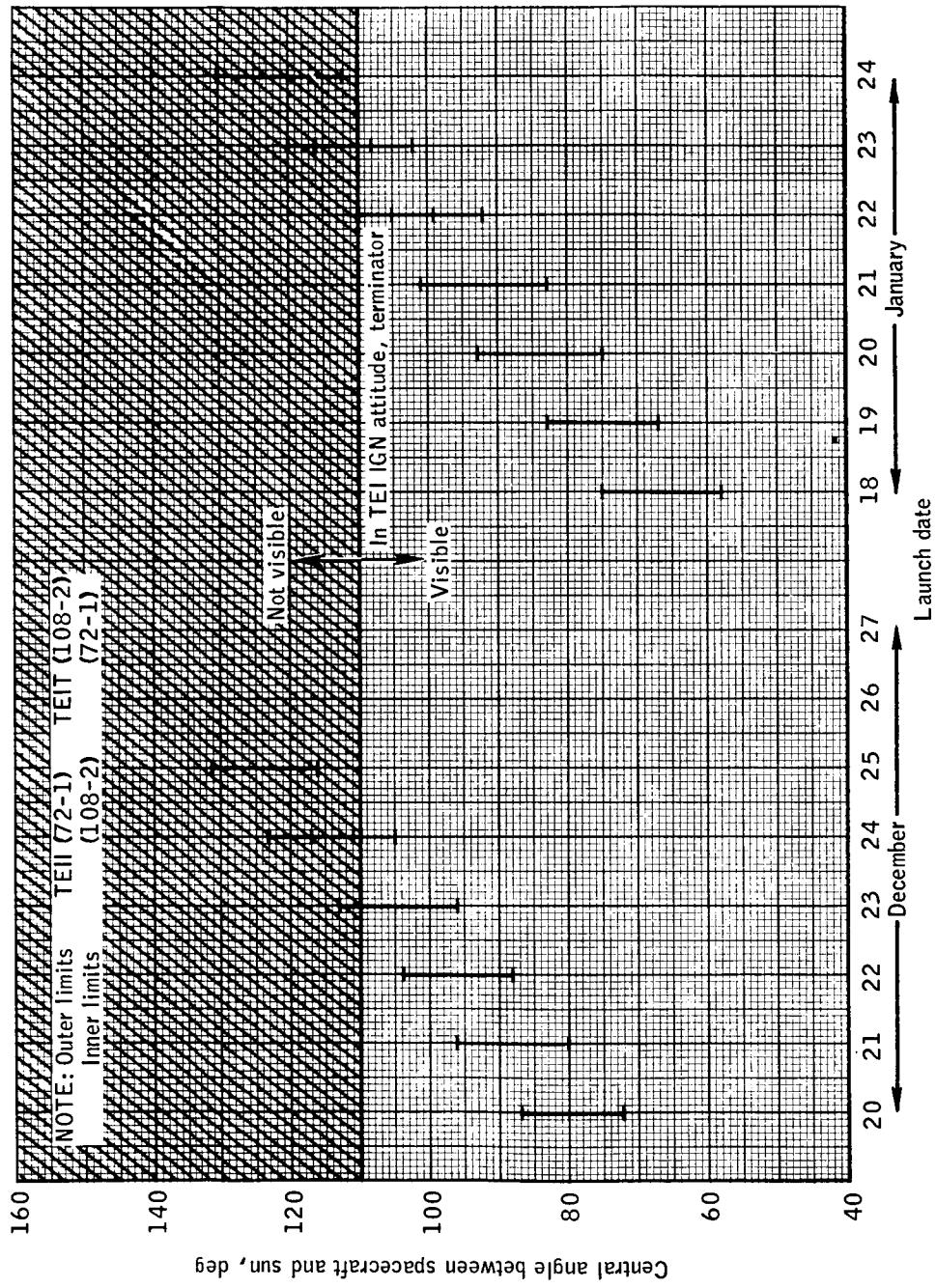


Figure 13.- Terminator visibility for December and January window.

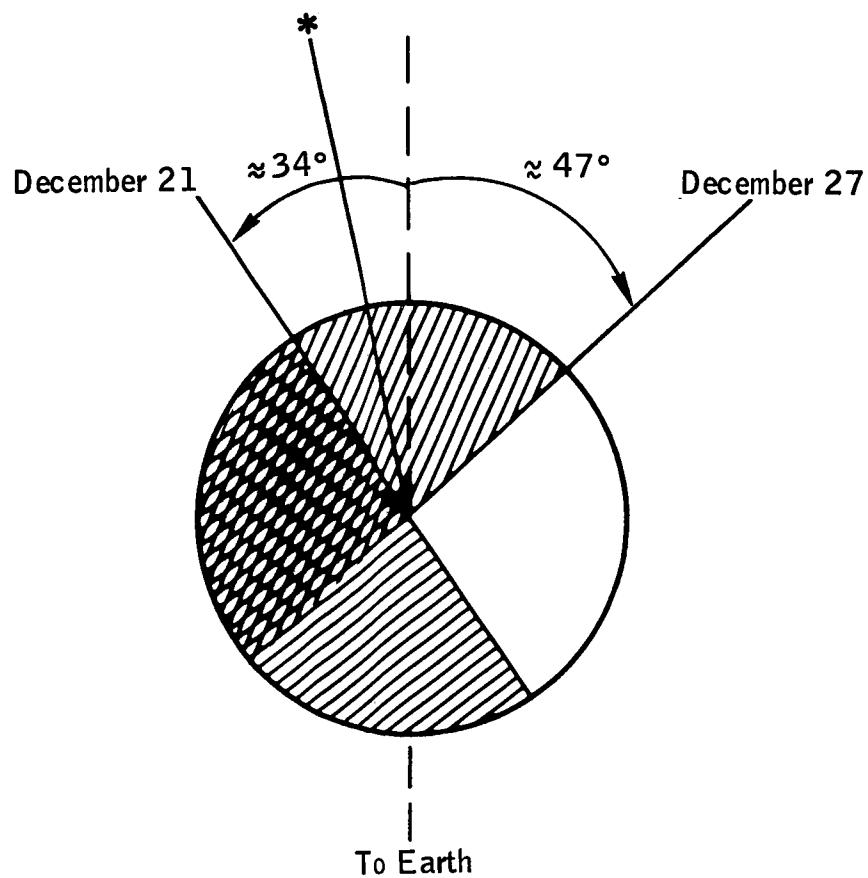


(b) Lunar orbit insertion.
Figure 13.- Continued.



(c) Transearth injection.

Figure 13 . - Concluded.



* Approximate
position of
LOI and TEI

Figure 14.- Approximate lunar lighting conditions for the December window.

SEQ	4	6	22	31	41	17	63	73	75	80	106	111	114
X	15	24	21	22	12	20	3	11	3	-9	-8	7	8
Y	-22	-7	-7	-5	-10	-4	-16	-5	-19	-19	-12	-4	-4
SEQ	120	149	150	151	186	205	207	215	221	222	230	231	
X	11	-1	2	5	-5	0	5	-16	-19	6	-13	-2	
Y	0	-3	-1	0	3	4	6	1	1	7	4	7	
SEQ	237	245	249	241	252	256	265	270	271	261			
X	-16	-12	-17	-10	-12	-21	-13	5	1	-5			
Y	4	5	5	7	7	5	6	11	11	12			

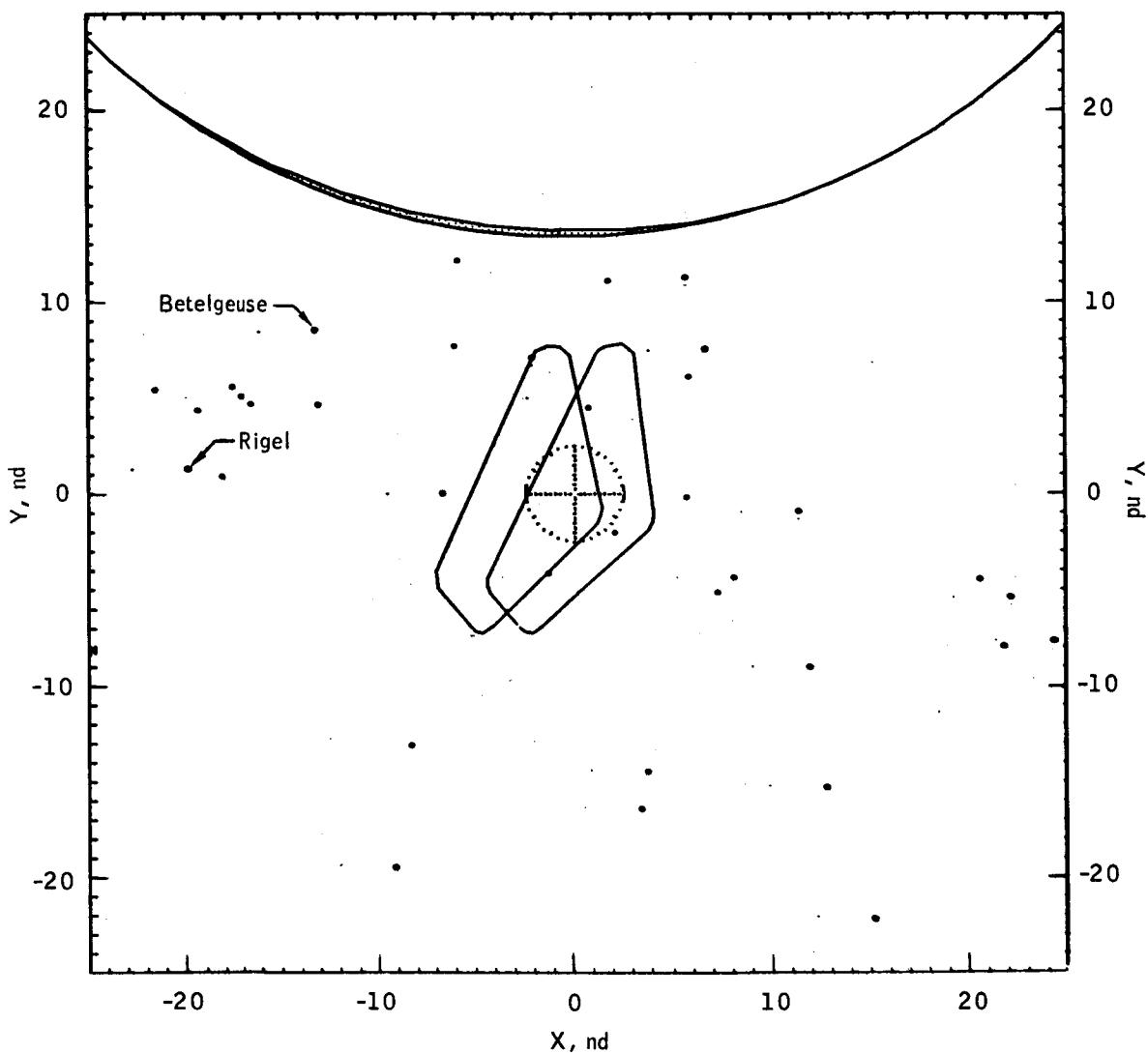


Figure 15a.- Launch date December 21, 1968; 90° launch azimuth; first opportunity.
Beginning of LOI burn.

SEQ	4	5	22	31	41	47	63	73	75	80	108	111	112	120
X	15	24	22	22	13	21	4	12	4	-6	-7	7	6	12
Y	-21	-7	-7	-4	-14	-4	-16	-8	-14	-19	-12	-4	-3	0

SEQ	144	150	151	186	205	207	215	221	222	230	231
X	0	2	6	-6	1	6	-17	-19	7	-12	-1
Y	-3	-1	0	0	4	6	1	1	7	4	7

SEQ	237	239	245	244	246	252	256	265
X	-16	-24	-18	-14	-5	-17	-21	-12
Y	4	2	4	5	8	5	5	8

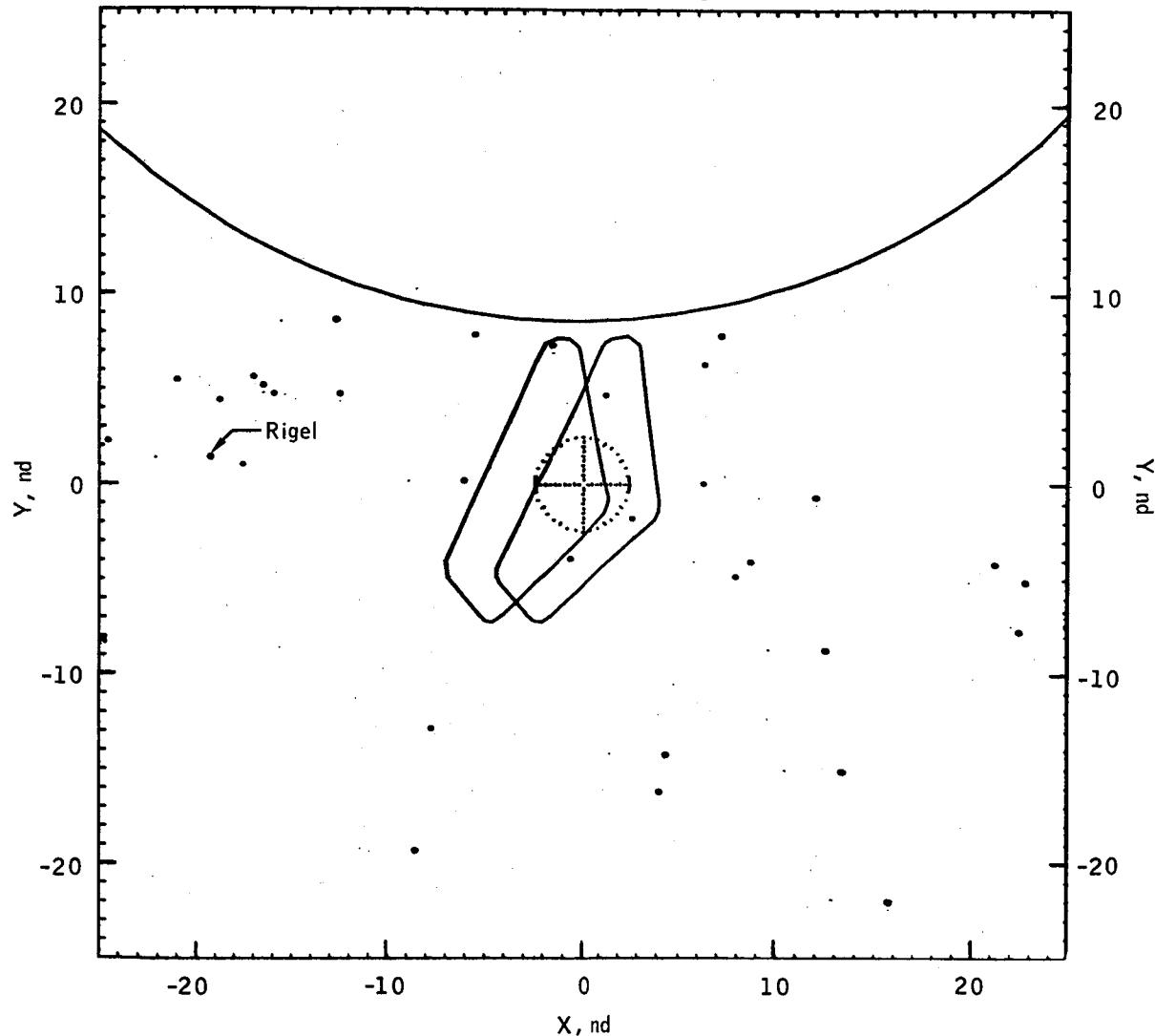


Figure 15b.- Launch date December 21, 1968; 90° launch azimuth; first opportunity.
Middle of LOI burn.

SEG	4	22	31	41	42	63	73	75	80	108	111	112	126
X	16	23	21	14	22	5	13	5	-7	-6	9	9	13
Y	-21	-7	-1	-14	-3	-15	-8	-13	-18	-12	-4	-3	0

SEG	144	150	151	186	205	216	221	230	233	237	239	245
X	0	-3	7	-4	2	-16	-18	-11	-24	-14	-23	-17
Y	-3	-1	0	0	5	1	1	5	1	5	2	4

SEG	246	252	256
X	-15	-15	-14
Y	5	6	5

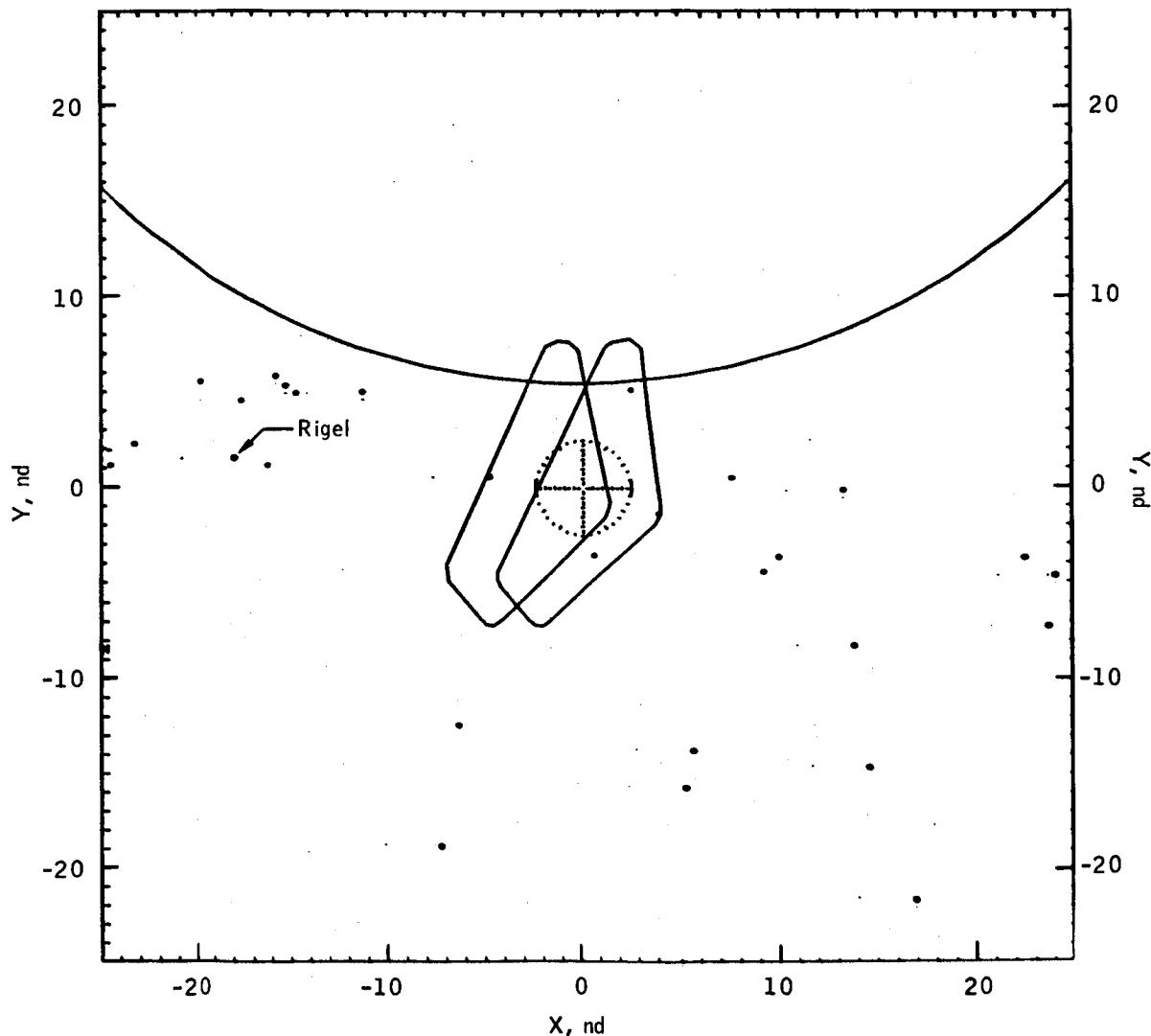


Figure 15c.- Launch date December 21, 1968; 90° launch azimuth; first opportunity.
End of LOI burn.

SEG	4	5	22	31	41	47	63	73	75	80	108	111	112
X	15	24	22	22	13	20	3	12	4	-8	-8	7	8
Y	-22	-7	-8	-5	-15	-4	-16	-9	-14	-19	-13	-5	-4

SEG	120	144	150	151	186	205	207	215	221	222	230	231
X	11	0	2	6	-6	1	6	-17	-19	6	-12	-1
Y	-1	-4	-2	0	0	4	5	0	1	7	4	6

SEG	237	239	245	246	248	252	256	265	270	271	281
X	-16	-24	-19	-16	-5	-17	-23	-13	5	1	-5
Y	4	1	4	4	7	5	8	11	10	11	

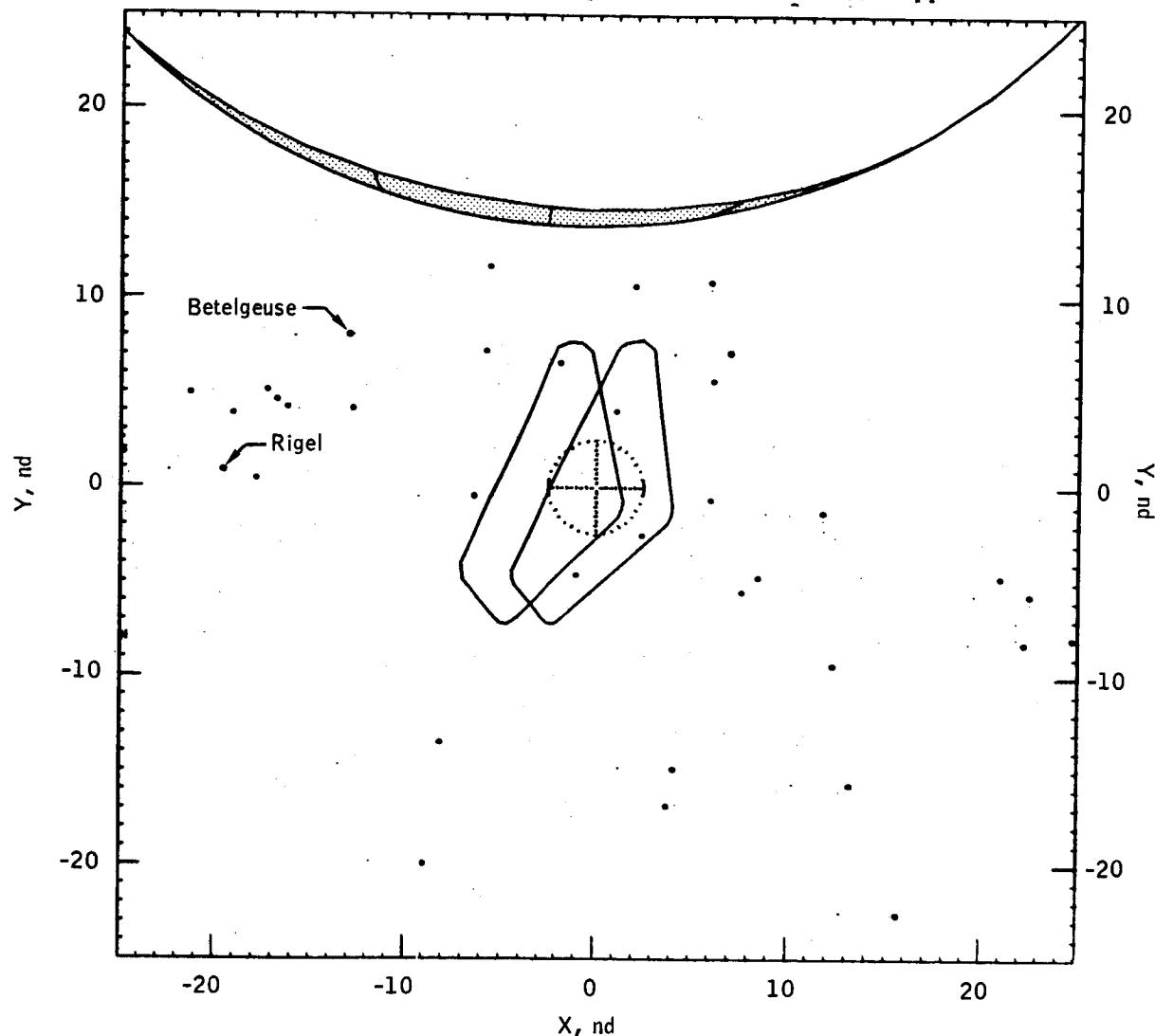


Figure 16a.- Launch date December 21, 1968; 108° launch azimuth; first opportunity.
Beginning of L01 burn.

SEQ	4	22	31	41	47	63	73	75	80	108	111	112	120
X	16	23	23	14	21	4	13	4	-8	-7	8	9	12
Y	-22	-7	-5	-15	-4	-16	-8	-14	-19	-13	-5	-4	0

SEG	144	150	151	186	205	207	215	221	222	230	231	237
X	0	3	6	-5	1	6	-17	-18	7	-12	-1	-15
Y	-4	-2	0	0	4	6	0	1	7	4	7	4

SEQ	239	245	246	248	252	256	265
X	-24	-18	-16	-5	-16	-20	-12
Y	1	4	4	7	5	5	8

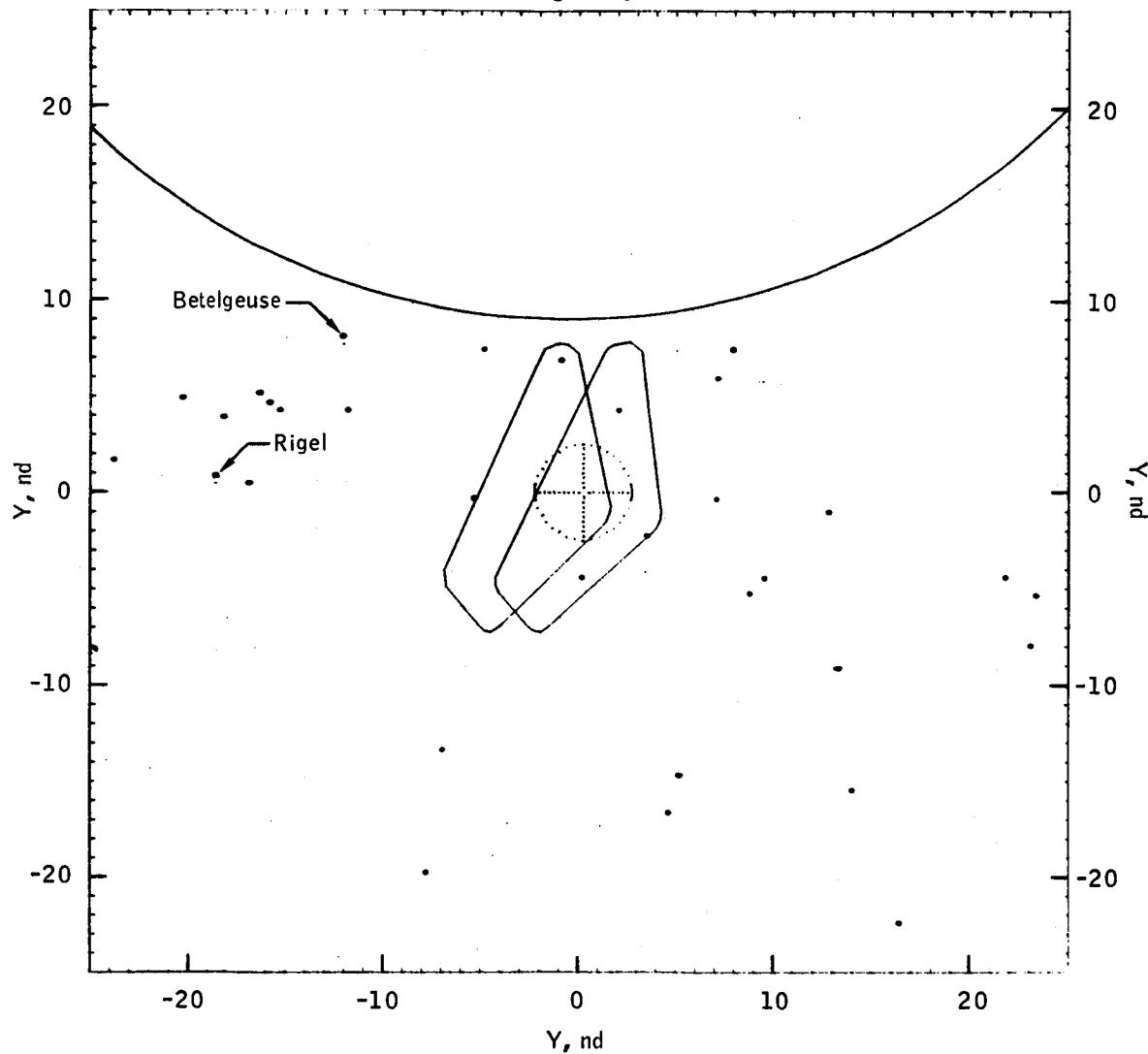


Figure 16b.- Launch date December 21, 1968; 108° launch azimuth; first opportunity.
Middle of LOI burn.

SEQ	4	22	41	47	63	73	75	80	108	111	112	120	144
X	-17	24	15	23	6	14	6	-6	-5	10	10	14	1
Y	-21	-7	-14	-3	-16	-8	-14	-19	-12	-4	-3	0	-3

SEG	150	151	186	205	215	221	230	233	237	239	245	246
X	4	6	-3	3	-15	-17	-10	-23	-13	-22	-16	-14
Y	-1	0	0	4	0	1	4	0	4	1	4	4

SEQ	252	256	290
X	-15	-19	-24
Y	5	5	8

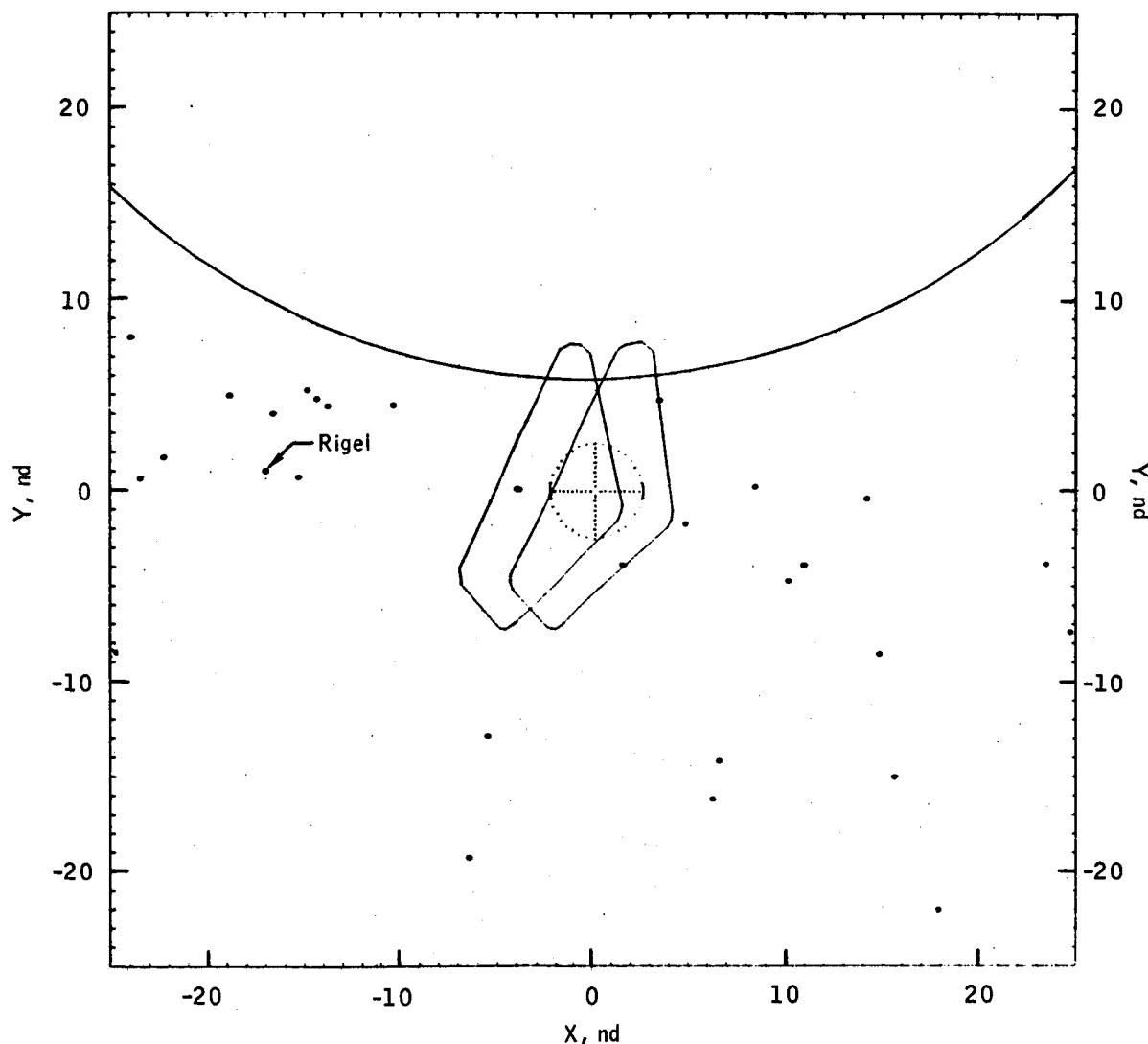


Figure 16c.- Launch date December 21, 1968; 108° launch azimuth; first opportunity.
End of LOI burn.

SEQ	21	31	41	71	111	112	120	144	150	151	166	205	207
X	21	24	22	14	6	4	12	0	3	6	-6	1	0
Y	-11	-15	-13	-21	-18	-17	-13	-10	-10	-13	-14	-7	-7

SEQ	215	221	222	230	231	237	245	246	248	252	256	265
X	-10	-17	7	-14	-1	-10	-19	-16	-5	-17	-21	-12
Y	-11	-11	-6	-8	-7	-8	-8	-7	-6	-7	-6	-9

SEQ	276	271	261	301	344	356	362
X	1	6	-5	-4	10	-13	-14
Y	-6	-2	-2	0	0	0	0

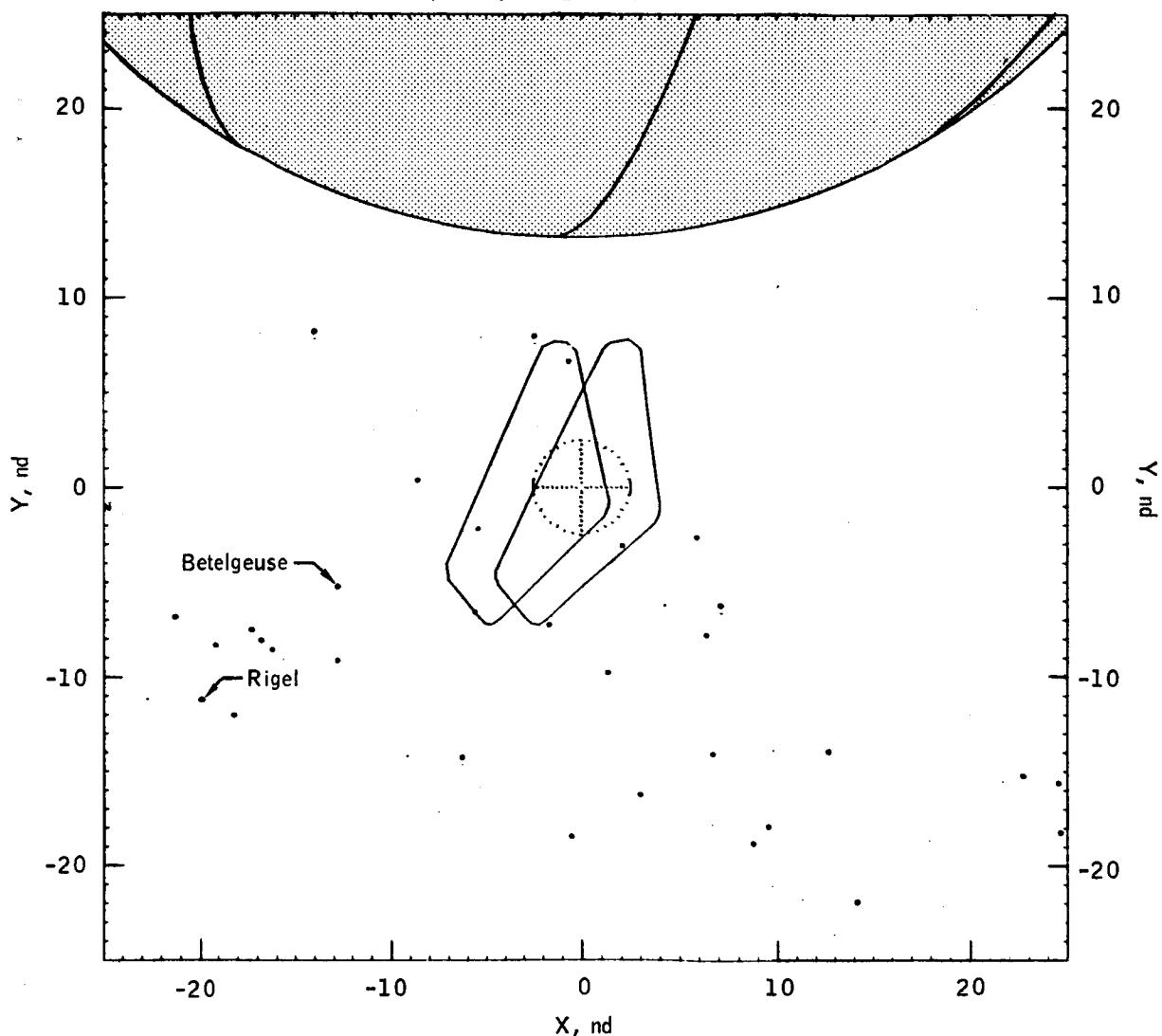


Figure 17a.- Launch date December 23, 1968; 72° launch azimuth; first opportunity.
Beginning of LOI burn.

SEQ	31	47	73	111	112	120	144	150	151	186	205	207	215
X	24	23	14	9	9	13	8	3	7	5	1	6	17
Y	-15	-14	-21	-18	-17	-13	-10	-15	-13	-13	-9	-7	-11
SEQ	221	222	230	231	237	239	245	246	248	252	256	265	
X	19	7	-12	-1	-15	-24	-18	-16	-5	-16	-20	-12	
Y	10	-5	-8	-6	-8	-8	-8	-7	-6	-7	-6	-4	
SEQ	270	271	281	301	308	349	356	362					
X	6	2	-4	-8	-24	0	-13	-1					
Y	-2	-2	-1	0	1	6	8	8					

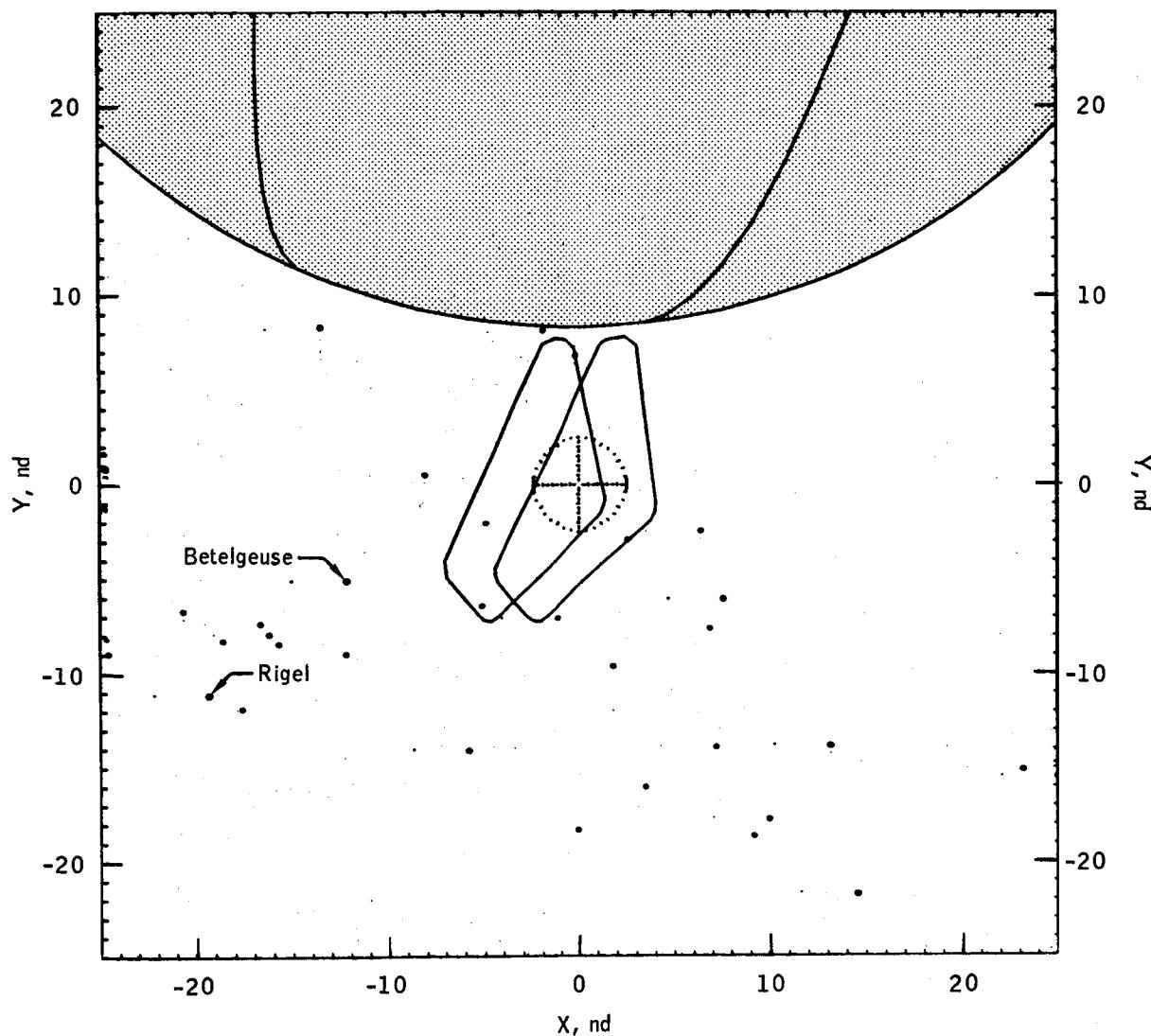


Figure 17b.- Launch date December 23, 1968; 72° launch azimuth; first opportunity.
Middle of LOI burn.

SEQ	47	73	111	112	120	144	150	151	186	205	207	215	221
X	24	15	10	10	14	0	4	8	-4	2	7	-16	-18
Y	-14	-21	-18	-17	-13	-17	-15	-13	-13	-9	-7	-11	-10

SEQ	222	230	231	237	239	245	246	248	252	256	265	270
X	8	-11	0	-14	-23	-17	-15	-4	-15	-19	-11	7
Y	-5	-8	-6	-7	-8	-7	-7	-5	-6	-6	-4	-1

SEQ	271	281	290	301	308
X	3	-4	-24	-7	-23
Y	-2	-1	-1	1	1

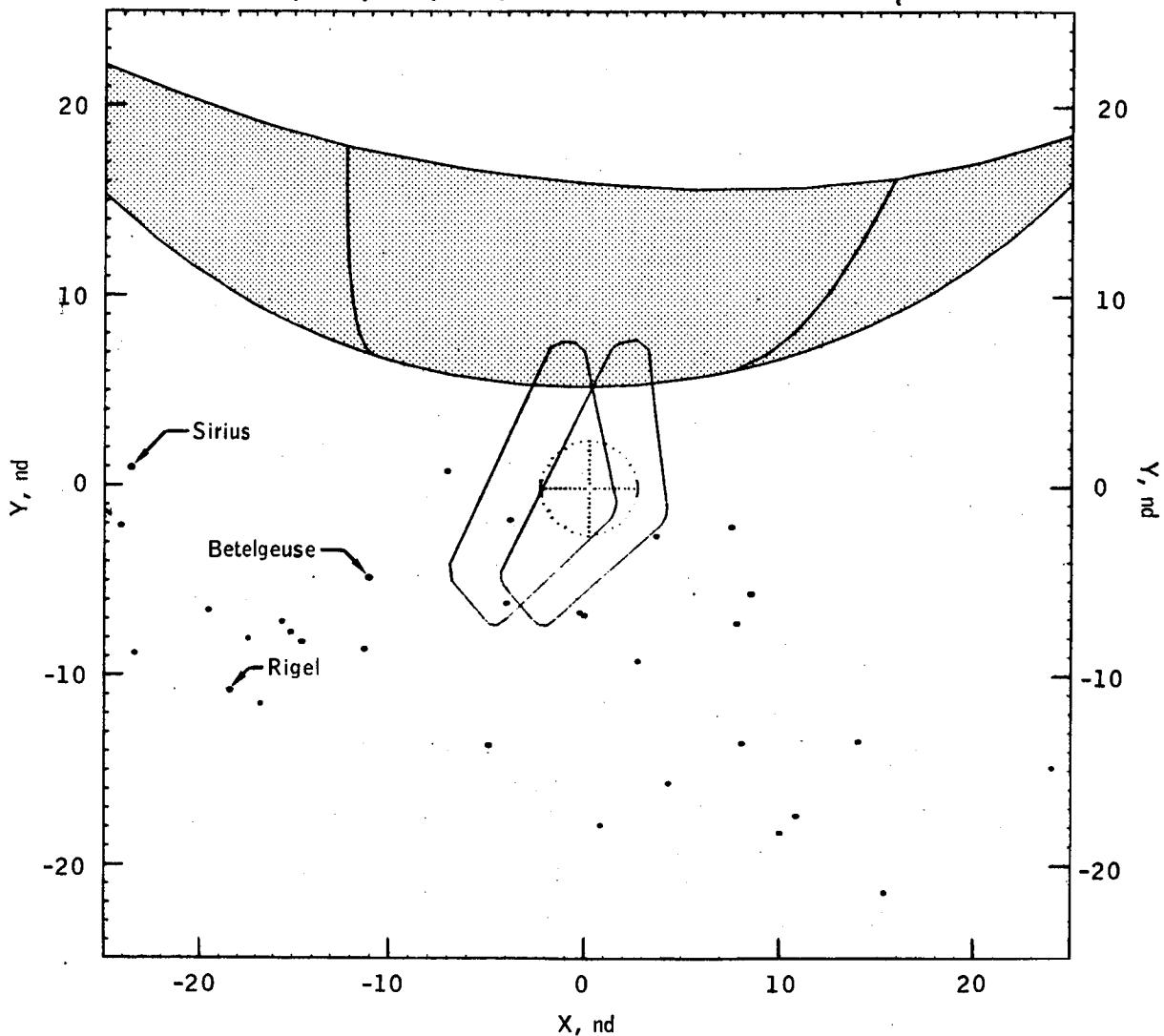


Figure 17c.- Launch date December 23, 1968; 72° launch azimuth; first opportunity.
End of TEI burn.

SEG	22	31	47	73	111	112	120	144	150	151	186	205	207
X	24	24	22	14	8	9	12	12	2	6	-6	1	6
Y	-15	-15	-15	-22	-19	-18	-14	-19	-16	-14	-15	-10	-8

SEG	215	221	222	230	231	237	245	246	248	252	256	265
X	-18	-20	6	-12	-1	-14	-19	-16	-5	-17	-21	-12
Y	-12	-11	-6	-9	-7	-9	-9	-8	-7	-8	-7	-5

SEG	270	271	281	301	349	356	362
X	5	1	-5	-8	0	-14	-2
Y	-3	-3	-2	0	5	7	7

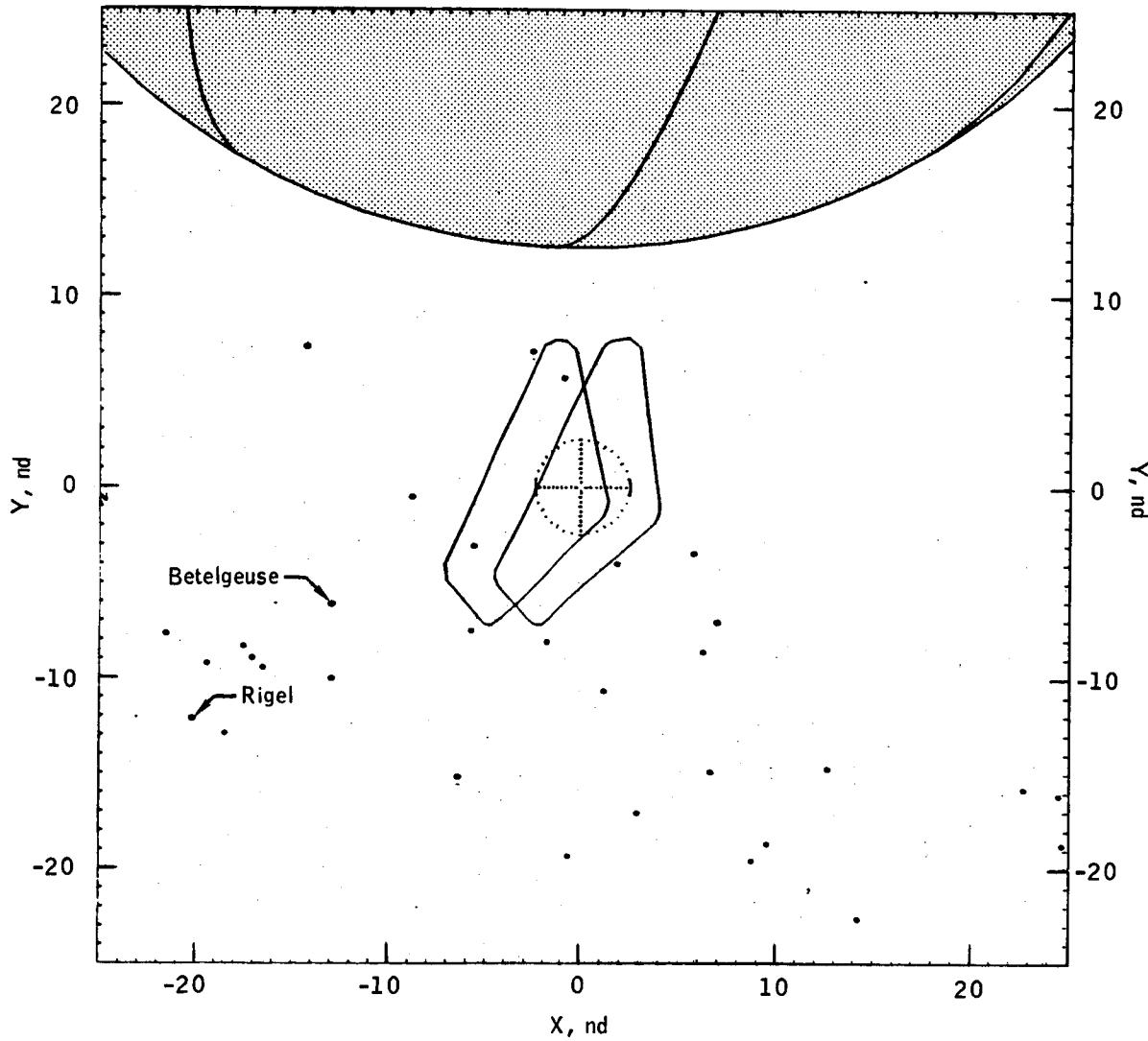


Figure 18a.- Launch date December 23, 1968; 90° launch azimuth; first opportunity.
Beginning of LOI burn.

SEG	24	31	47	74	111	112	120	144	150	151	166	205	261
X	24	24	22	14	8	9	12	0	3	6	-6	1	6
Y	-18	-15	-15	-22	-14	-18	-14	-19	-16	-14	-14	-16	-8

SEG	215	221	222	230	231	237	245	246	248	252	254	265
X	-18	-19	7	-12	-1	-16	-19	-16	-5	-17	-21	-14
Y	-12	-11	-6	-9	-7	-9	-8	-8	-7	-8	-7	-5

SEG	270	271	281	301	349	356	367
X	5	2	-5	-8	0	-13	-2
Y	-3	-3	-2	0	6	7	7

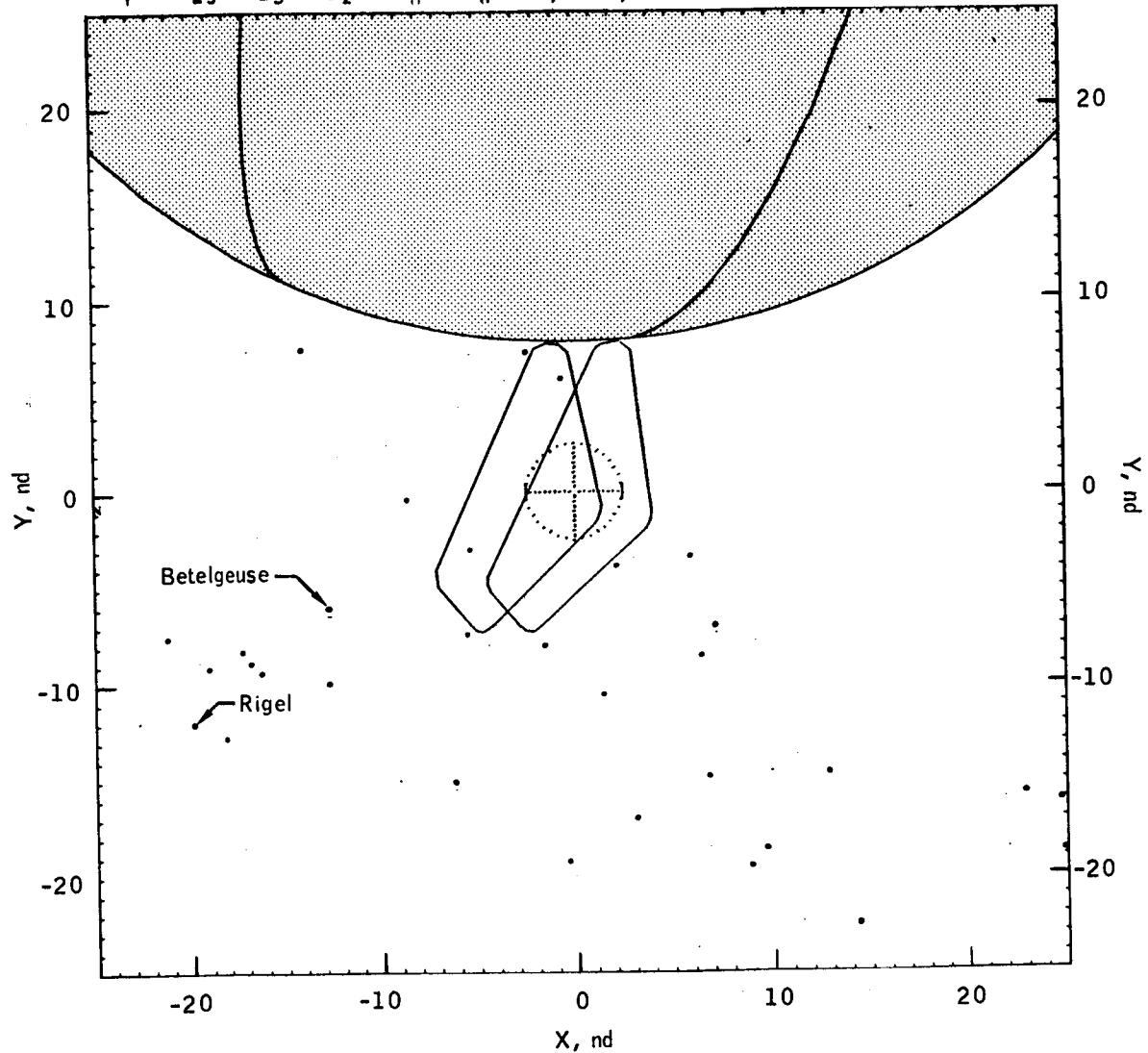


Figure 18b.- Launch date December 23, 1968; 90° launch azimuth; first opportunity.
Middle of LOI burn.

SEQ	47	73	111	112	120	144	150	151	184	205	207	215	221
X	23	14	9	10	13	0	3	7	-5	-1	7	-17	-19
Y	-15	-22	-19	-18	-14	-18	-16	-14	-14	-10	-8	-12	-11

SEQ	222	230	231	237	239	245	246	248	252	256	265	270
X	7	-12	-1	-15	-24	-18	-16	-4	-16	-20	-12	6
Y	-6	-9	-7	-8	-9	-8	-8	-6	-7	-7	-5	-2

SEQ	271	281	301	308
X	2	-4	-8	-24
Y	-3	-2	0	0

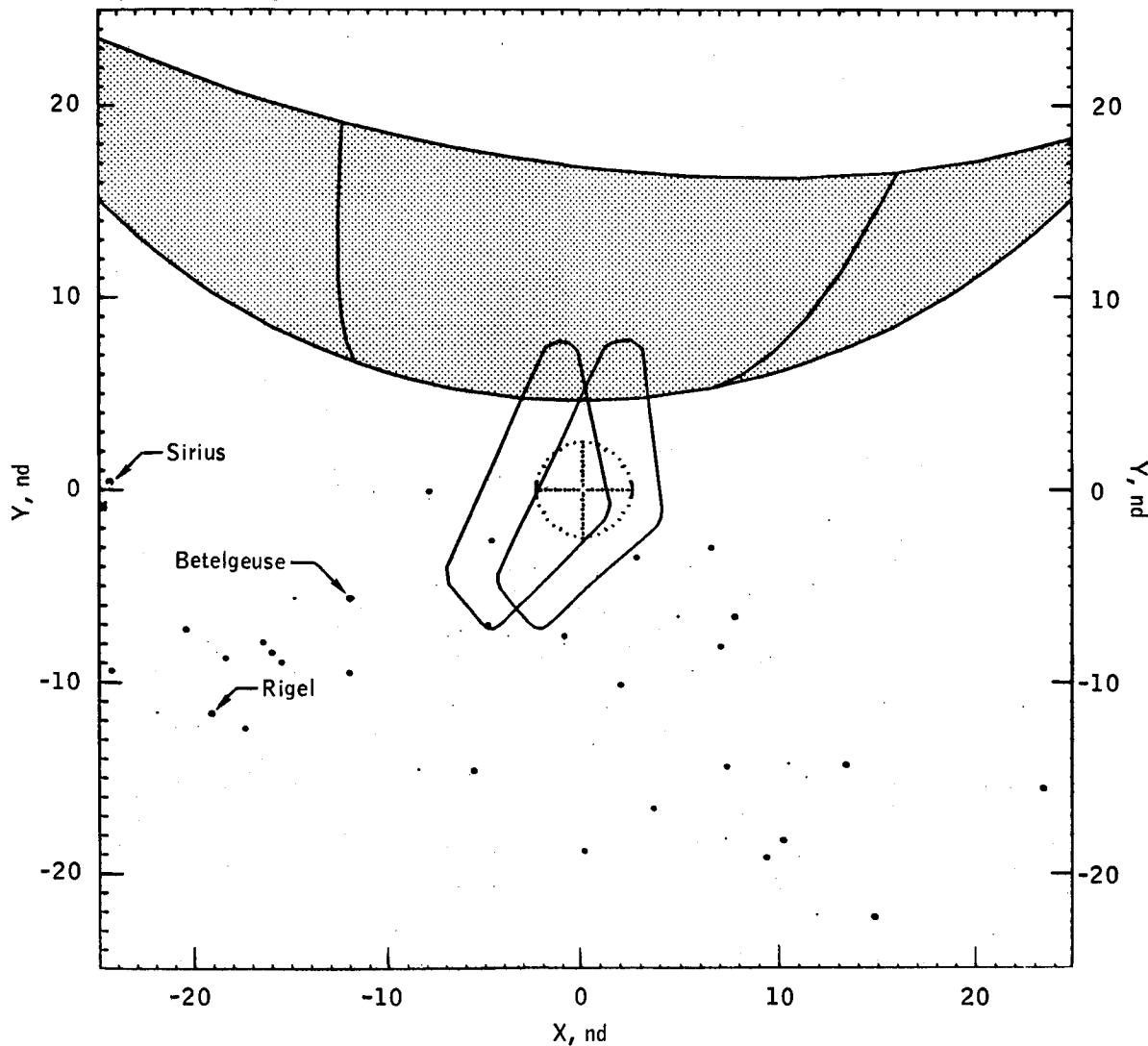


Figure 18c.- Launch date December 23, 1968; 90° launch azimuth; first opportunity.
End of LOI burn.

SEG	41	47	73	75	108	111	112	120	144	150	151	186	205
X	16	23	14	6	-6	9	10	13	C	4	7	-4	2
Y	-24	-11	-17	-24	-23	-14	-13	-9	-14	-11	-9	-10	-5

SEG	207	215	221	222	230	231	233	237	239	245	246	248
X	7	-16	-18	8	=11	0	=24	-14	=23	-17	-15	-4
Y	-3	-8	-7	-1	-5	-2	-7	-4	-6	-4	-4	-2

SEG	252	256	265	270	271	281	290	301	308	349	356	362
X	-15	-19	-11	6	3	-4	-24	-7	-24	0	-13	-1
Y	-3	-3	-1	1	1	1	0	4	3	10	11	12

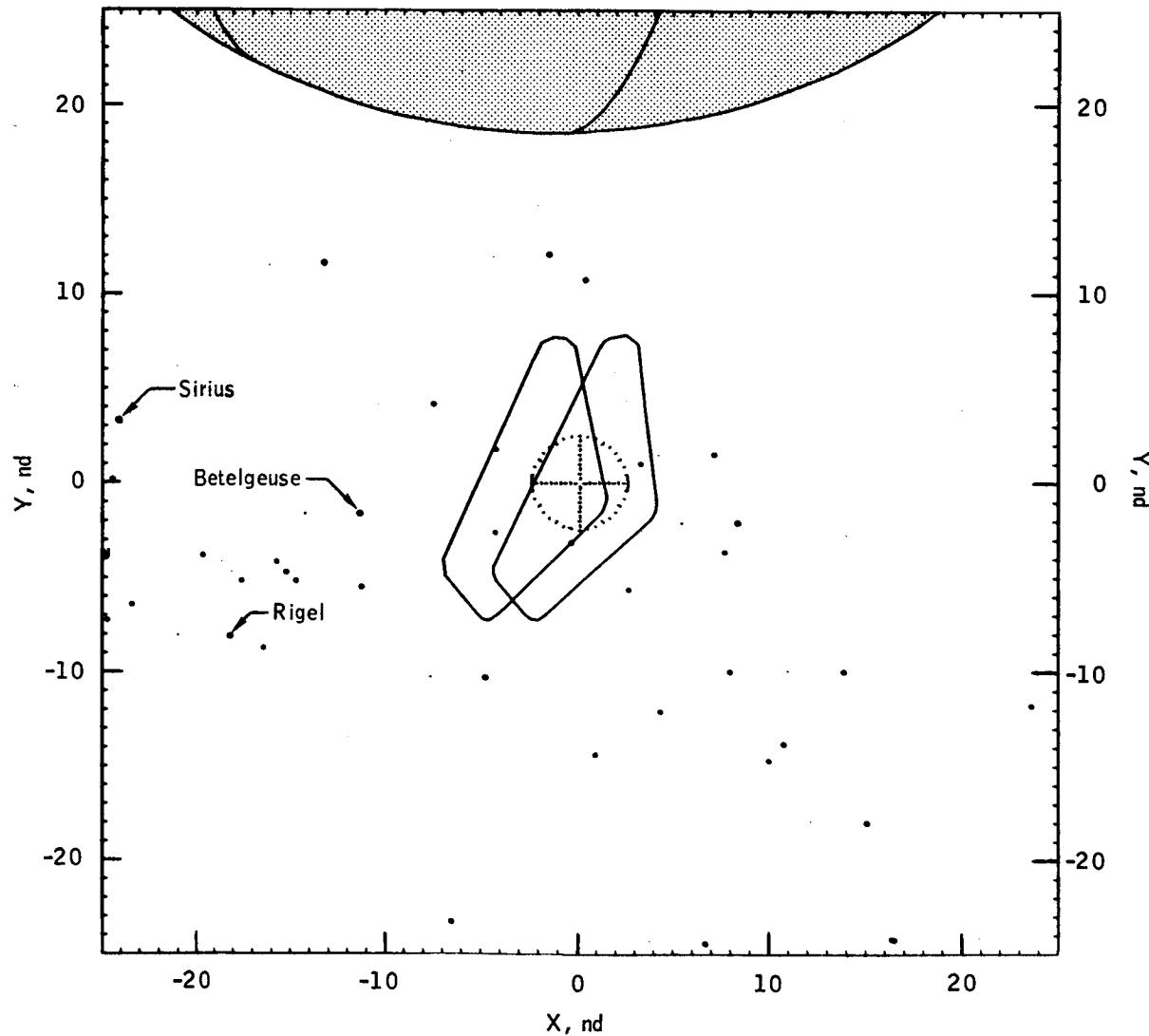


Figure 19a.- Launch date December 23, 1968; 108° launch azimuth; first opportunity.
Beginning of LOI burn.

SEG	41	47	73	75	108	111	112	120	144	150	151	186	205
X	17	24	15	7	-5	10	11	14	1	4	8	-4	3
Y	-24	-11	-17	-24	-23	-14	-13	-9	-14	-11	-9	-10	-5

SEG	207	215	221	222	230	231	233	237	239	245	246	248
X	8	-15	-17	9	-10	0	-24	-14	-22	-16	-14	-3
Y	-3	-8	-7	-1	-5	-3	-7	-5	-6	-5	-4	-2

SEG	252	256	265	270	271	281	290	301	308	349	356	362
X	-15	-19	-10	7	3	-3	-23	-6	-23	0	-12	0
Y	-4	-3	-1	1	1	1	0	4	3	10	11	12

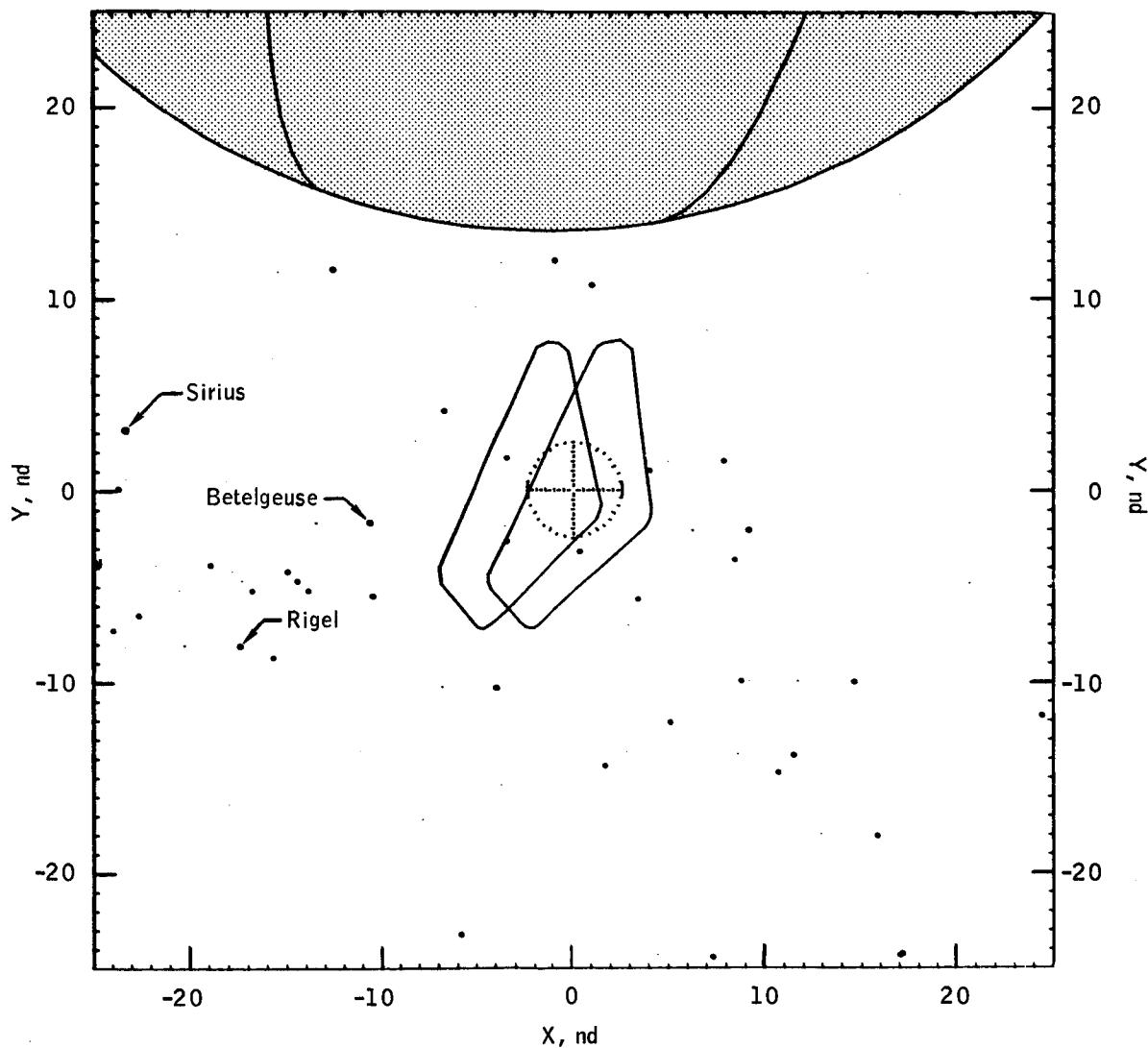


Figure 19b.- Launch date December 23, 1968; 108° launch azimuth; first opportunity.
Middle of LOI burn.

SEG	4 ₁	7 ₃	75	10 ⁸	111	112	120	144	150	151	186	205	207
X	18	17	8	-4	12	12	16	2	6	10	-2	4	9
Y	-23	-17	-23	-22	-14	-13	-9	-13	-11	-9	-9	-5	-3
SEG	21 ⁵	221	222	23 ₀	231	233	237	23 ⁹	245	246	248	252	
X	-14	-15	10	-8	1	-22	-12	-21	-15	-12	-1	-13	
Y	-8	-7	-1	-5	-2	-6	-4	-6	-4	-4	-2	-3	
SEG	256	265	270	271	281	290	301	306					
X	-17	-9	9	5	-1	-22	-5	-21					
Y	-3	-1	2	1	2	0	4	3					

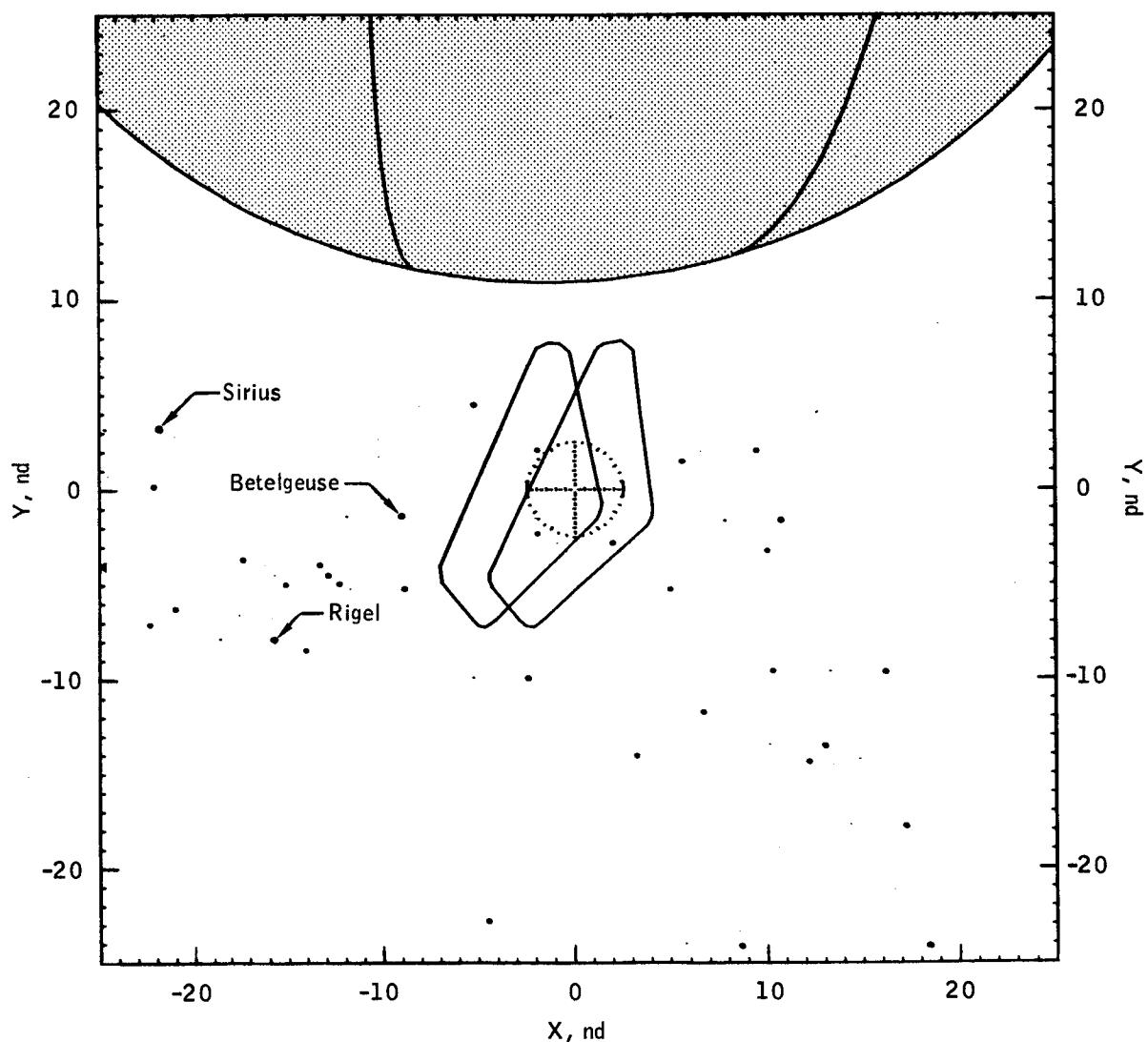


Figure 19c. - Launch date December 23, 1968; 108° launch azimuth; first opportunity.
End of LOI burn.

SEQ	340	356	362	440	473	480	507	509	515	535	540	57	58n
X	-1	-12	0	-14	-3	1	19	21	4	3	20	23	17
Y	-21	-18	-20	-2	-2	-2	-6	-7	2	8	-2	0	7

SEQ	674	639
X	24	24
Y	6	13

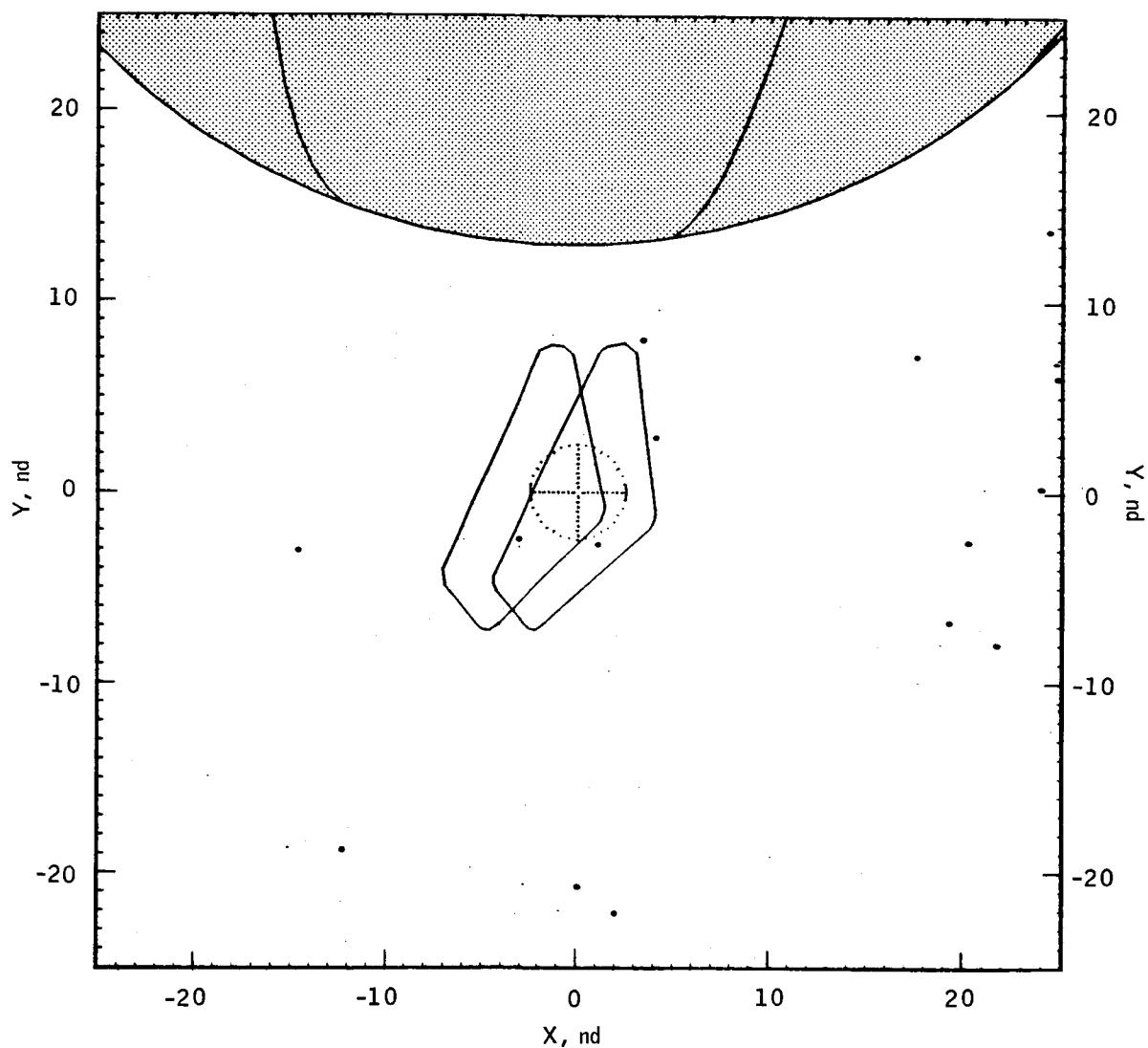


Figure 20a.- Launch date December 27, 1968; 72° launch azimuth; first opportunity.
Beginning of LOI burn.

SEC	307	319	356	362	372	440	473	480	507	509	515	535	540	577	580
X	-24	2	-11	0	-24	-13	-2	-1	19	22	4	3	20	24	18
Y	-18	-20	-17	-16	-7	-2	-1	-1	-5	-6	4	9	-1	1	8

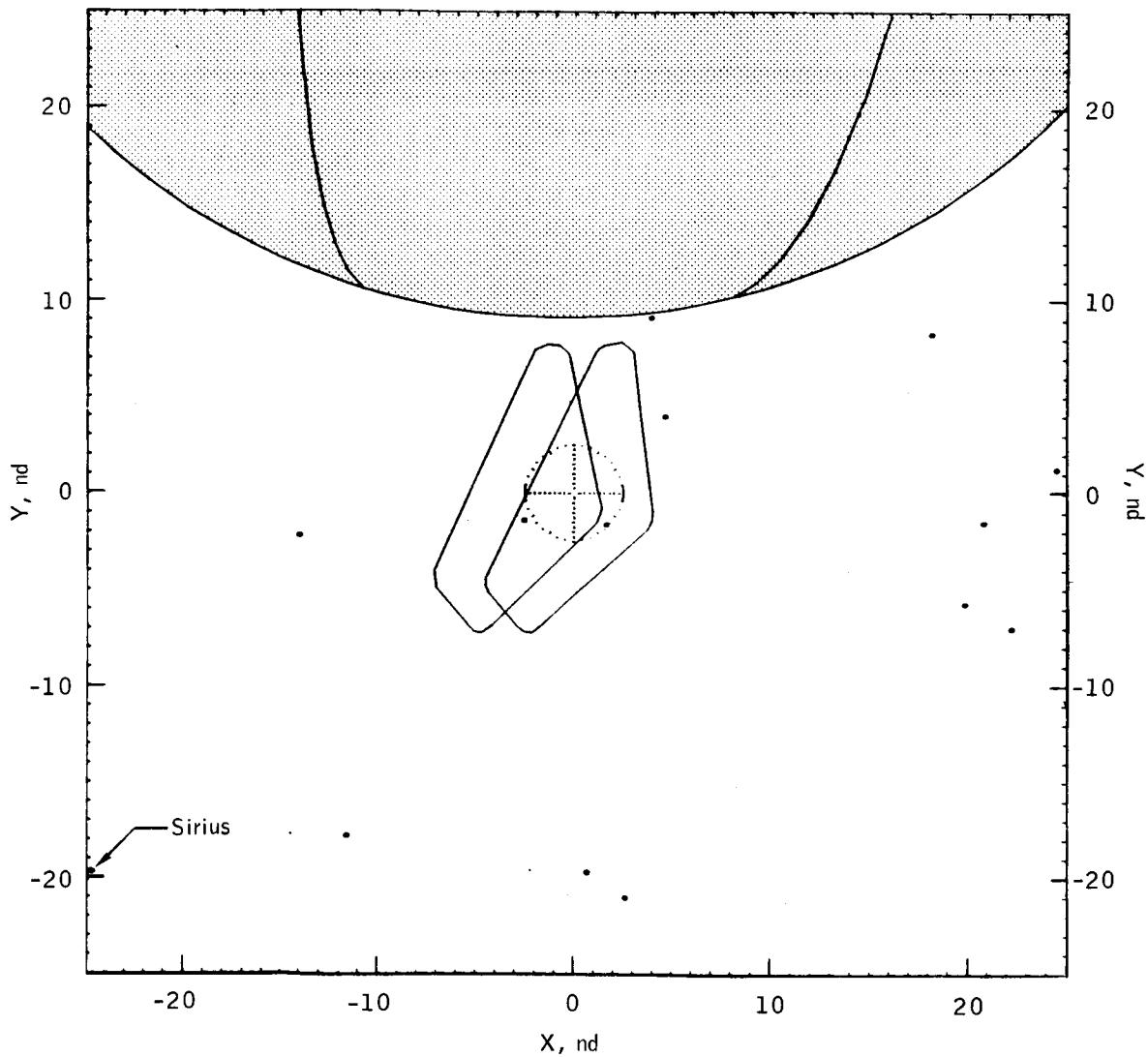


Figure 20b.- Launch date December 27, 1968; 72° launch azimuth; first opportunity.
Middle of LOI burn.

SEG	297	308	349	356	362	377	440	473	480	507	509	515	540
X	-24	-23	3	-10	1	-23	-12	-1	2	21	23	5	22
Y	-27	-16	-19	-16	-18	-6	0	1	0	-4	-5	5	0

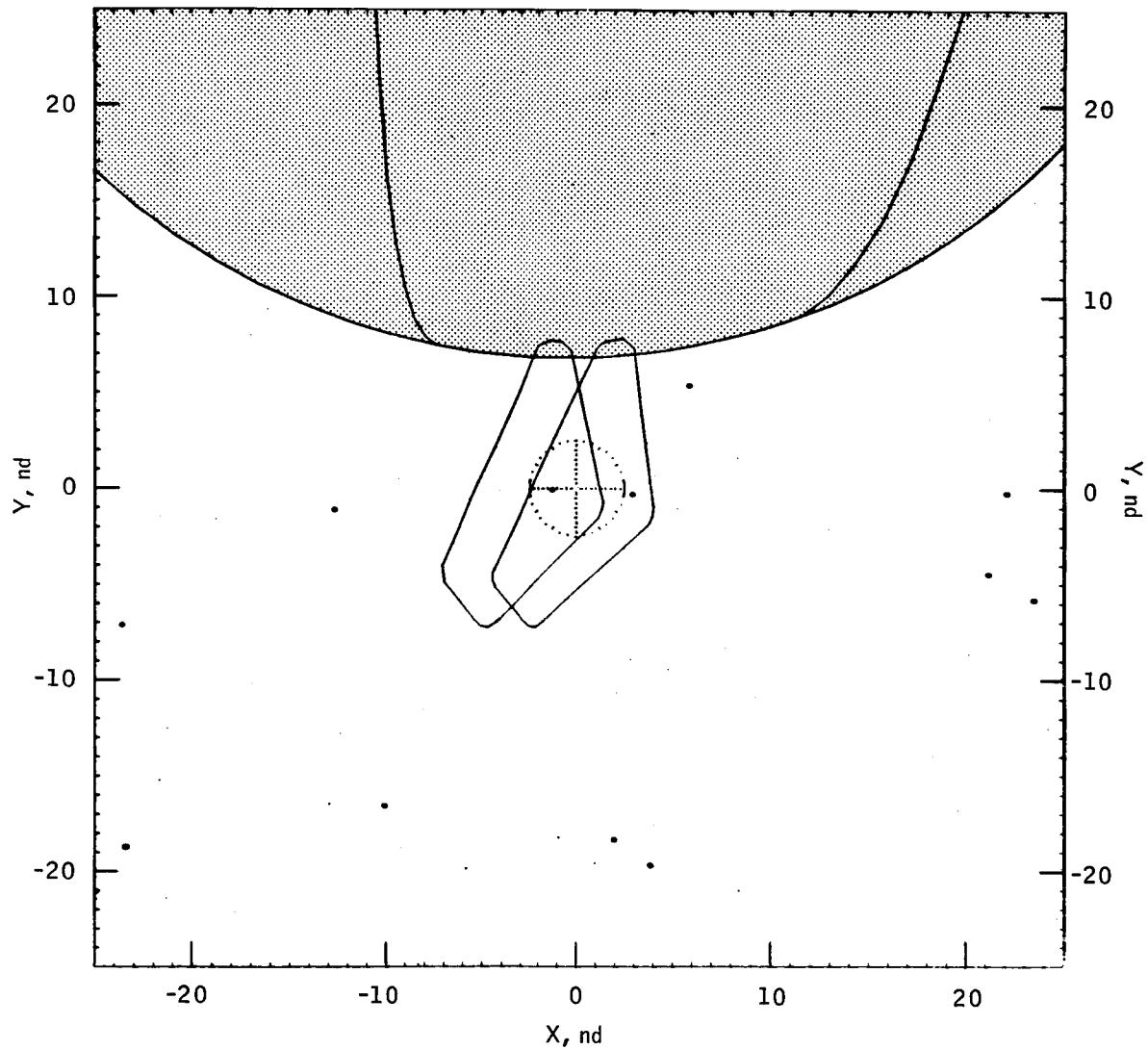


Figure 20c.- Launch date December 27, 1968; 72° launch azimuth; first opportunity.
End of LOI burn.

SEG	346	356	362	440	473	480	507	509	515	535	540	577	580
X	-1	-13	0	-15	-4	0	17	20	3	2	19	23	16
Y	-22	-19	-21	-7	-2	-3	-6	-8	2	7	-2	0	6

SEG	592	604	639
X	24	23	23
Y	2	5	13

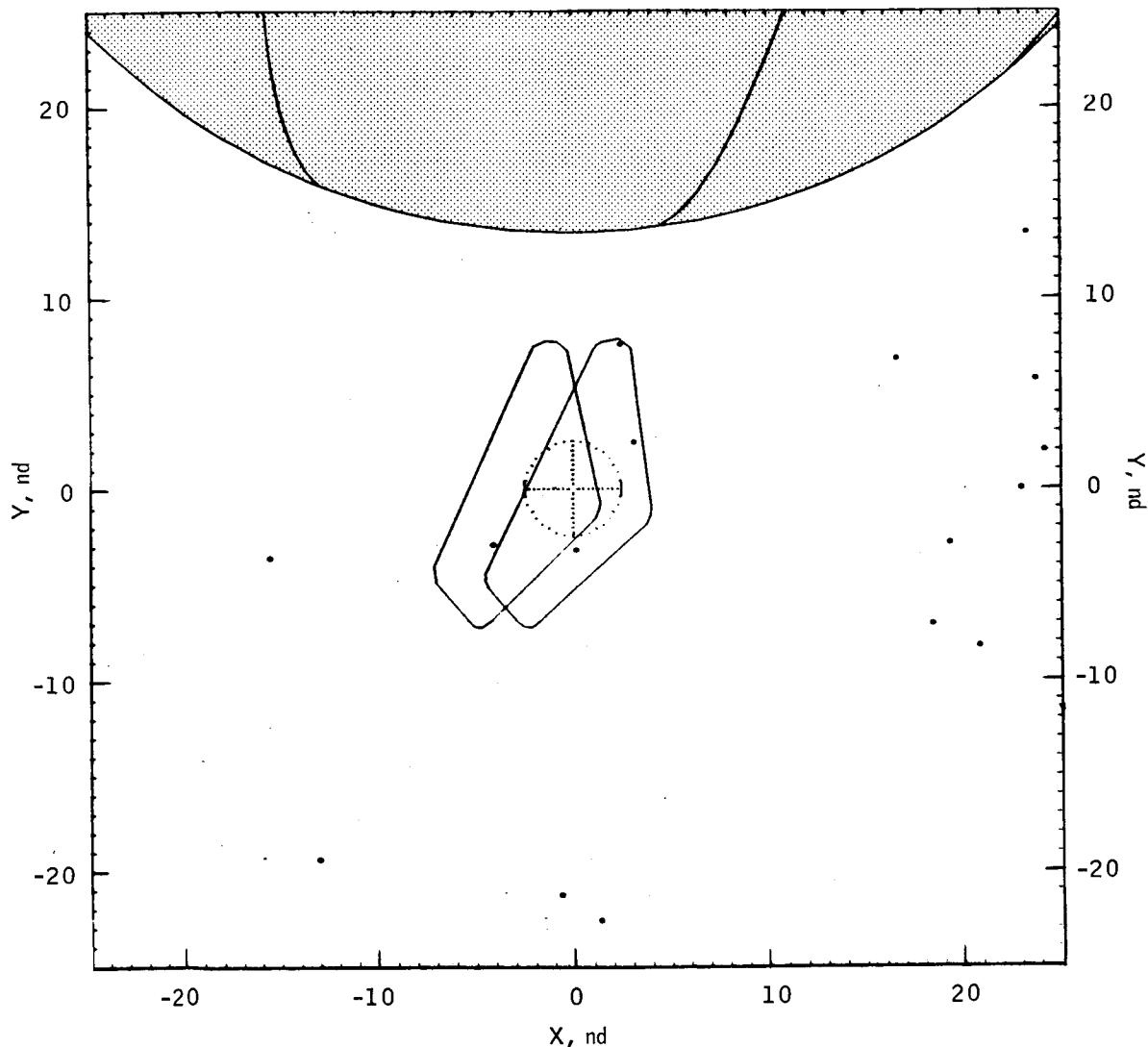


Figure 21a.- Launch date December 27, 1968; 90° launch azimuth; first opportunity.
Beginning of L01 burn.

SEG	349	356	362	440	473	480	507	509	515	535	540	577	580
X	3	-13	0	-15	-4	0	18	20	3	2	19	22	16
Y	-21	-18	-20	-2	-2	-2	-6	-7	3	8	-2	0	7

SEG	592	604
X	24	23
Y	2	6

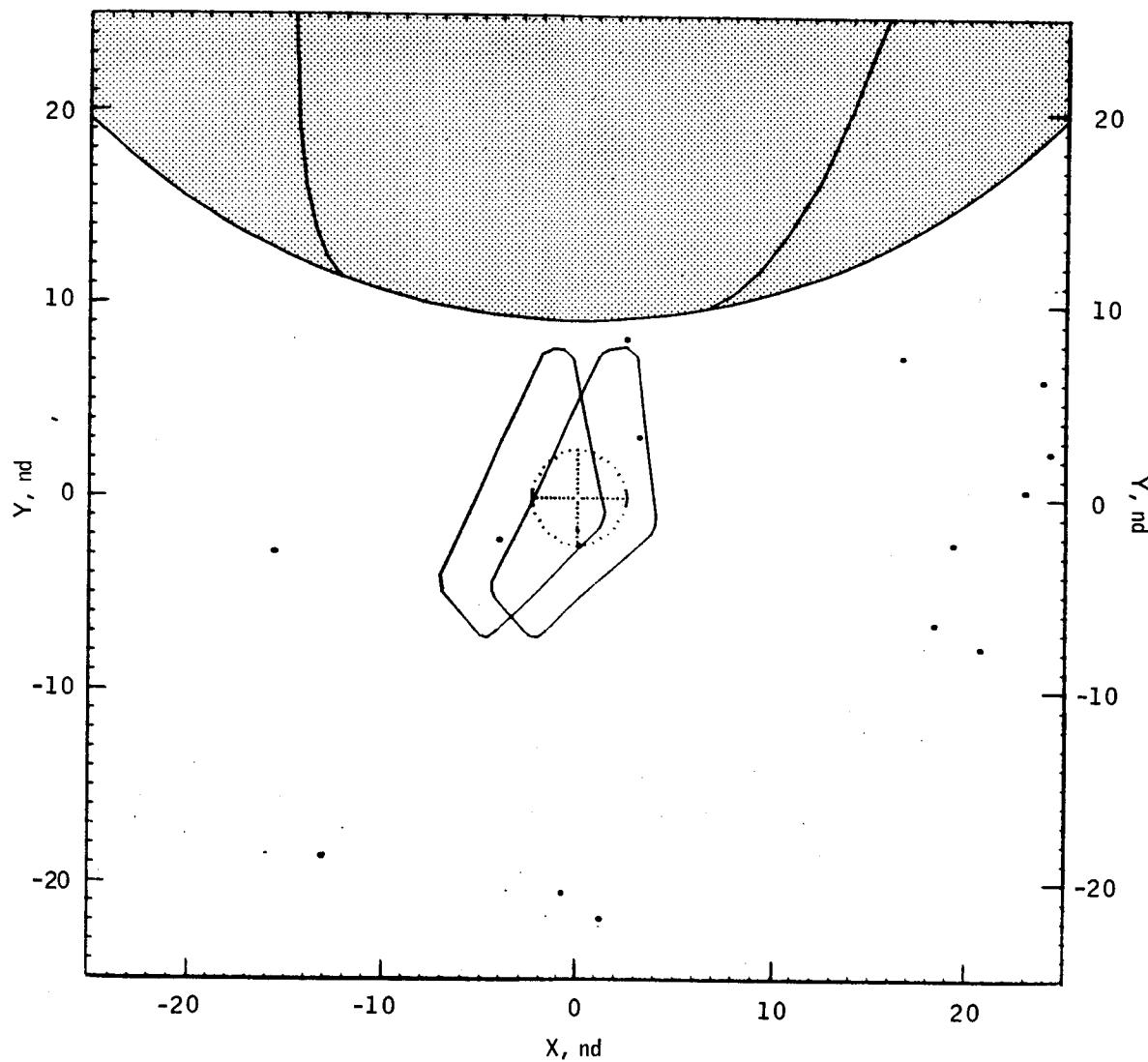


Figure 21b.- Launch date December 27, 1968; 90° launch azimuth; first opportunity.
Middle of LOI burn.

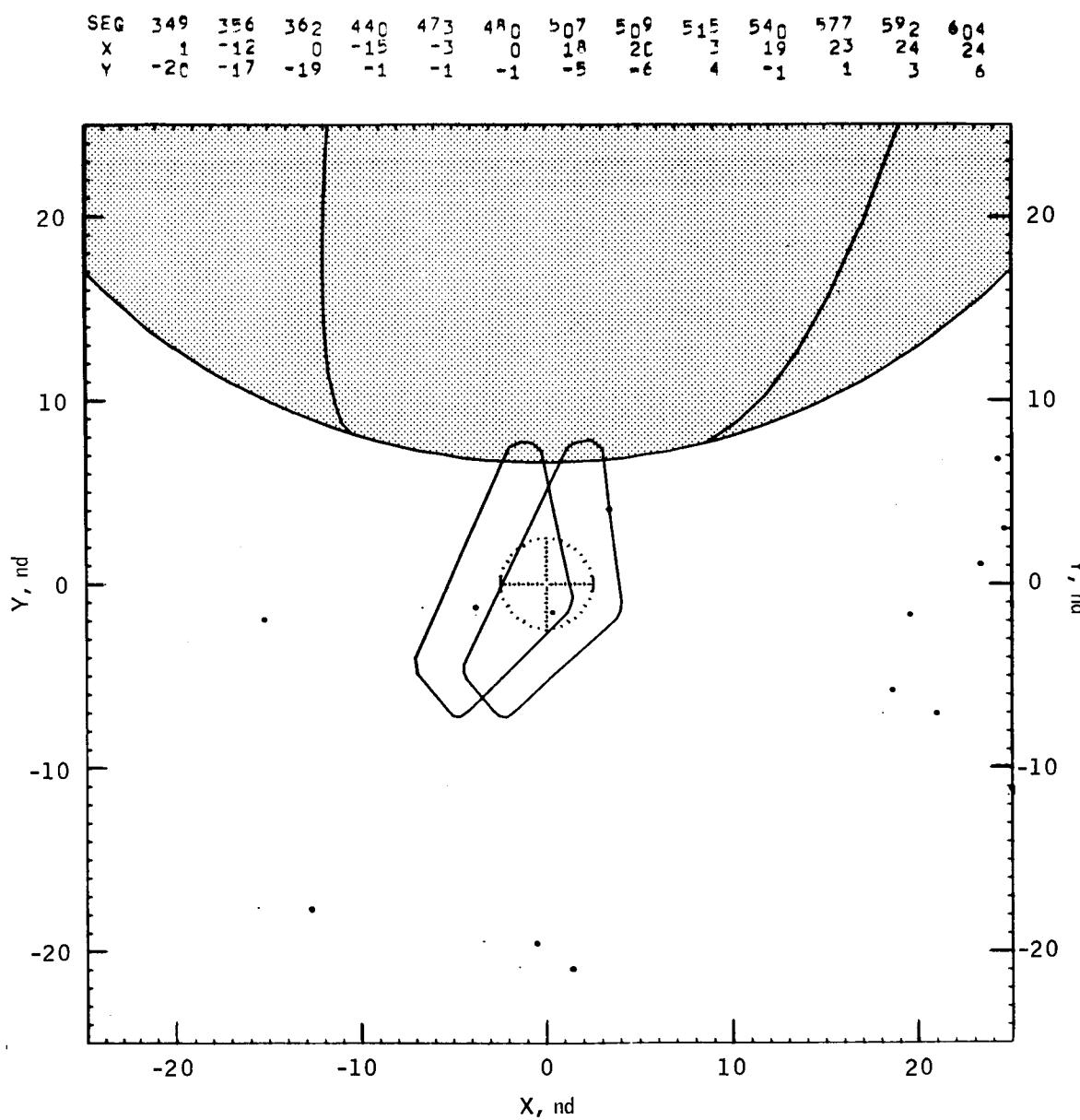


Figure 21c.- Launch date December 27, 1968; 90° launch azimuth; first opportunity.
End of LOI burn.

SEQ	349	356	362	440	473	480	507	509	515	535	540	577	580
X	1	-12	0	-14	-3	0	19	21	3	2	19	23	17
Y	-22	-19	-21	-3	-3	-3	-7	-8	2	7	-3	0	6

SEG	592	604	639
X	24	24	23
Y	1	5	13

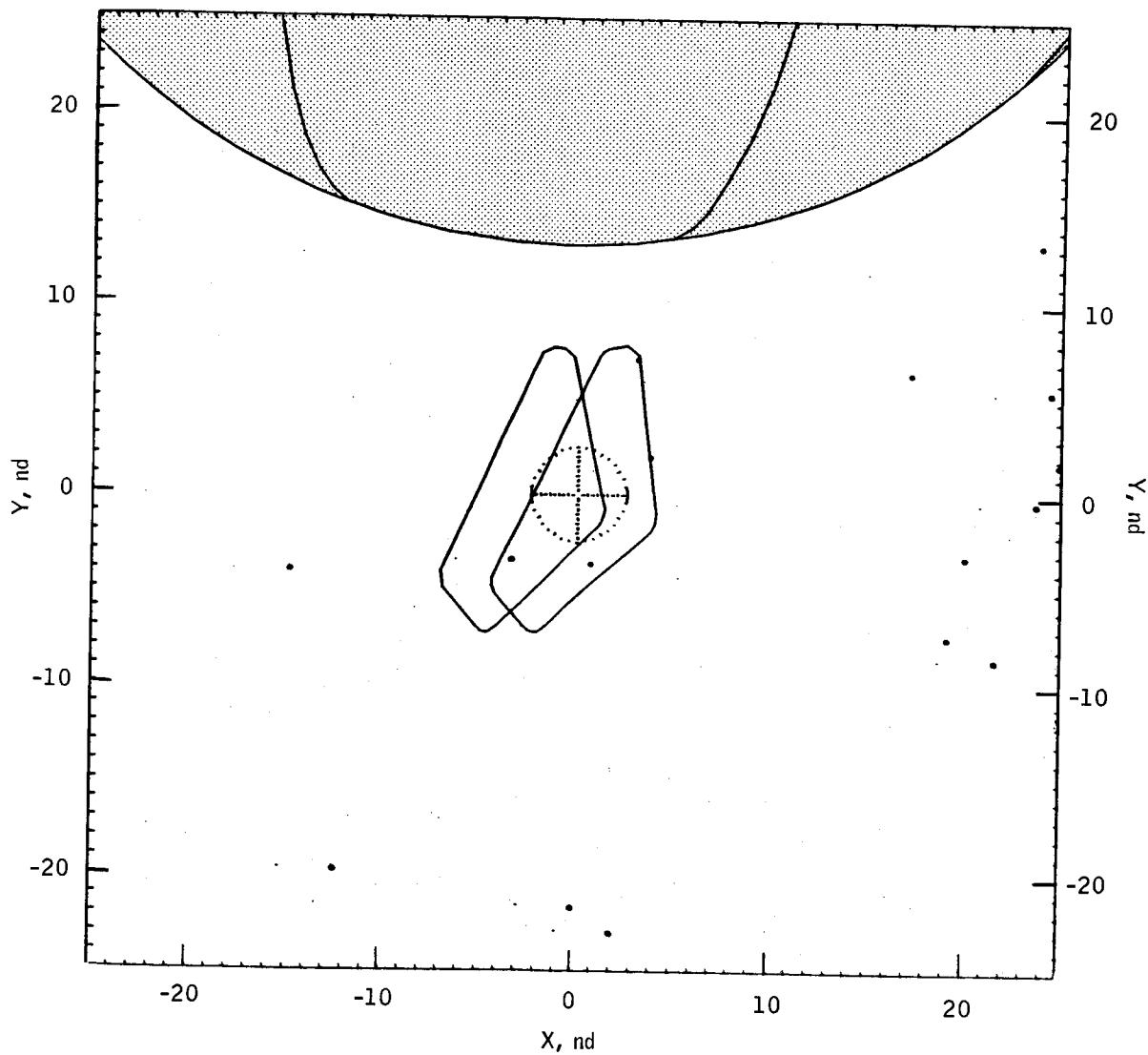


Figure 22a.- Launch date December 27, 1968; 108° launch azimuth; first opportunity.
Beginning of LOI burn.

SEQ	349	356	362	440	473	480	507	509	515	535	540	577	580	604
X	2	-11	0	-14	-3	1	19	21	4	3	20	24	17	24
Y	-21	-18	-20	-3	-2	-2	-6	-7	3	8	-2	0	7	0

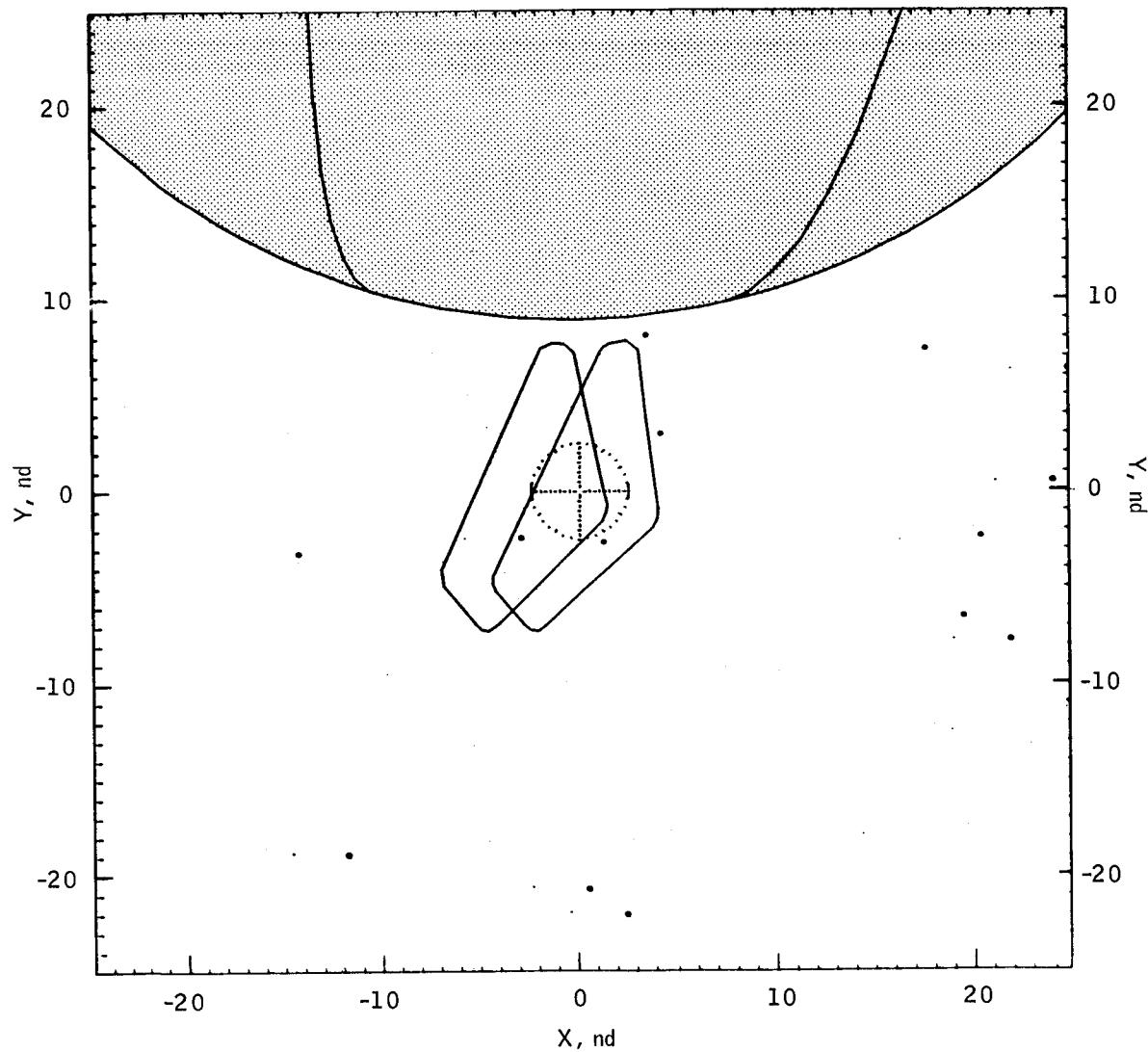


Figure 22b.- Launch date December 27, 1968; 108° launch azimuth; first opportunity.
Middle of LOI burn.

SEQ	308	349	356	162	377	440	473	480	507	509	515	540	577
X	-24	3	-10	1	-24	-13	-2	2	20	22	5	21	24
Y	-19	-20	-17	-19	-7	-2	-1	-1	-5	-6	4	-1	1

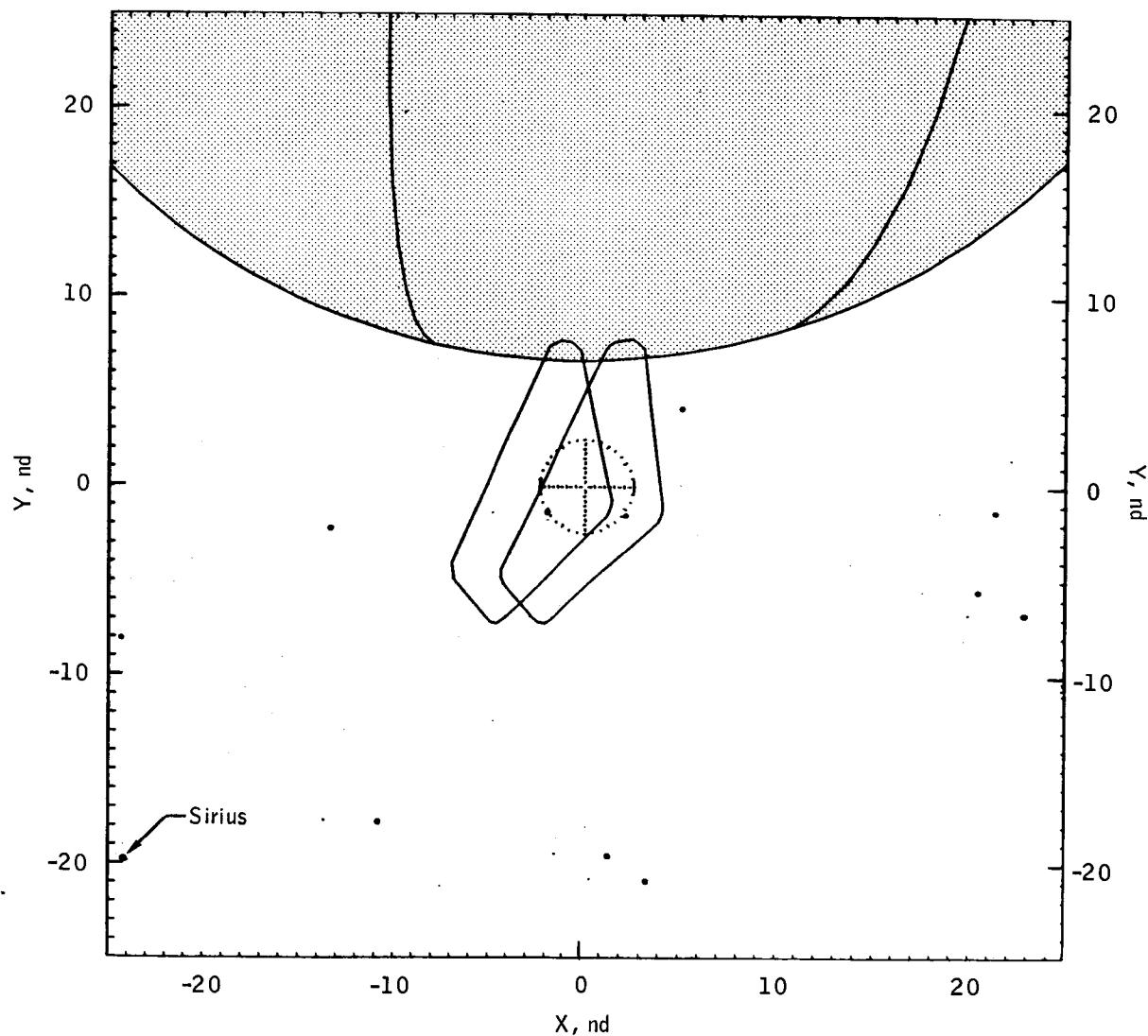


Figure 22c.- Launch date December 27, 1968; 108° launch azimuth; first opportunity.
End of L01 burn.

SEQ	757	781	789	790	793	795	797	802	803	836	841	844	861
X	19	12	3	9	3	-21	6	4	-17	0	1	-2	-2
Y	1	1	2	1	1	4	1	0	3	-2	-3	-3	-6

SEG	871	904	907	909	933	1001	1010	1028
X	0	-20	-19	-15	14	13	20	15
Y	-7	-13	-13	-13	-11	-21	-16	-23

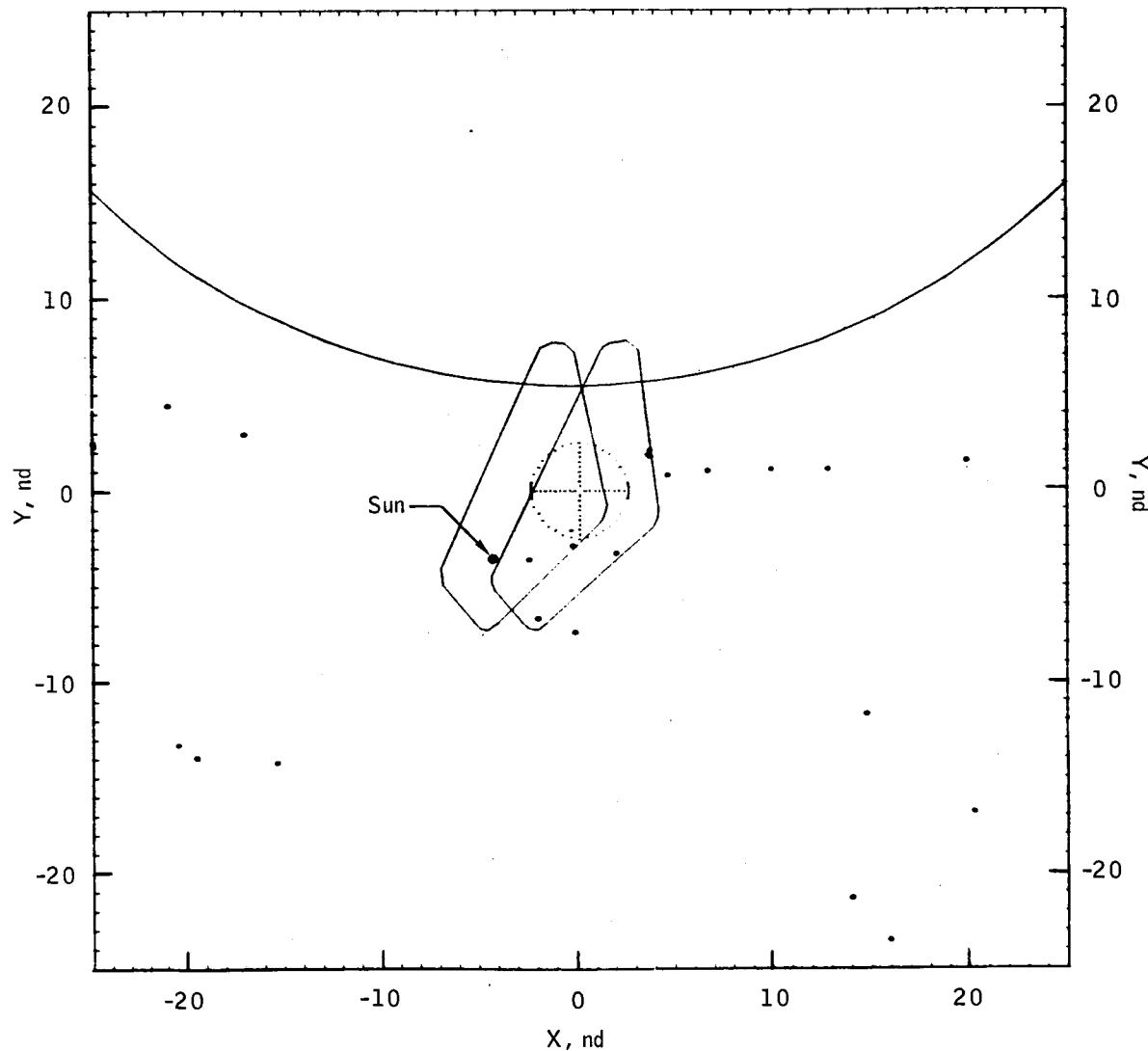


Figure 23a.- Launch date December 21, 1968; 90° launch azimuth; first opportunity.
Beginning of TEI burn.

SEG	757	759	770	781	789	790	793	795	797	802	803	836	841
X	19	2	-6	12	3	9	3	-21	6	4	-17	0	1
Y	1	6	6	1	2	1	1	4	1	0	3	-2	-3

SEQ	844	861	871	904	907	909	933	1001	1010	1028
X	-2	-2	0	-20	-19	-15	14	13	19	15
Y	-3	-6	-7	-13	-13	-14	-11	-21	-16	-23

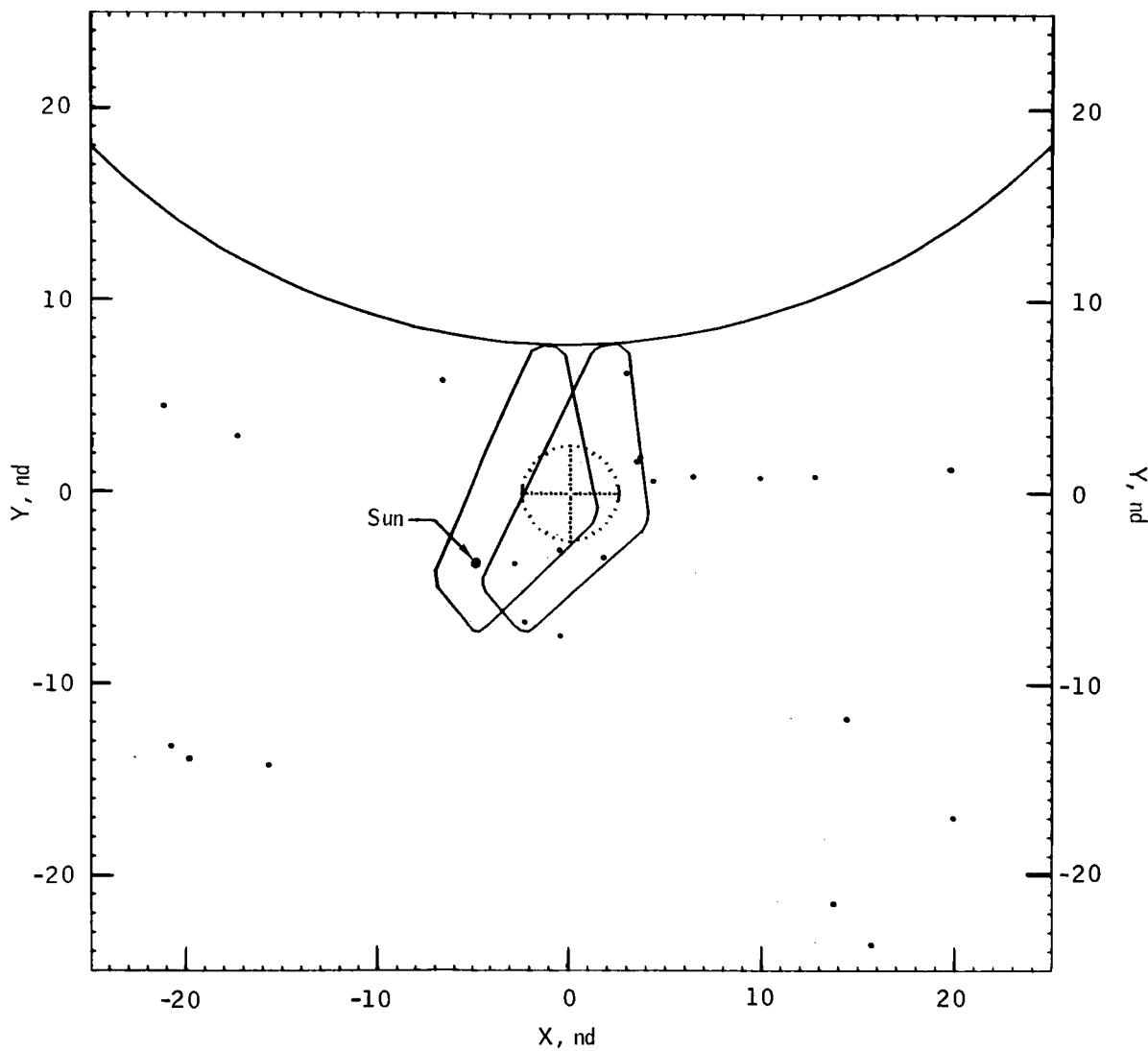


Figure 23b.- Launch date December 21, 1968; 90° launch azimuth; first opportunity.
Middle of TEI burn.

SEG	617	643	736	743	751	753	757	759	770	781	789	790	793
X	2	19	0	0	0	-8	19	2	-7	12	3	9	3
Y	11	9	10	9	8	10	1	6	5	0	1	0	1

SEG	795	797	802	803	836	841	844	861	871	904	907	909
X	-21	5	3	-17	0	1	-3	-2	0	-21	-20	-16
Y	4	0	0	3	-2	-3	-3	-6	-7	-13	-13	-14

SEG	933	1001	1010	1028
X	13	13	19	15
Y	-11	-21	-16	-23

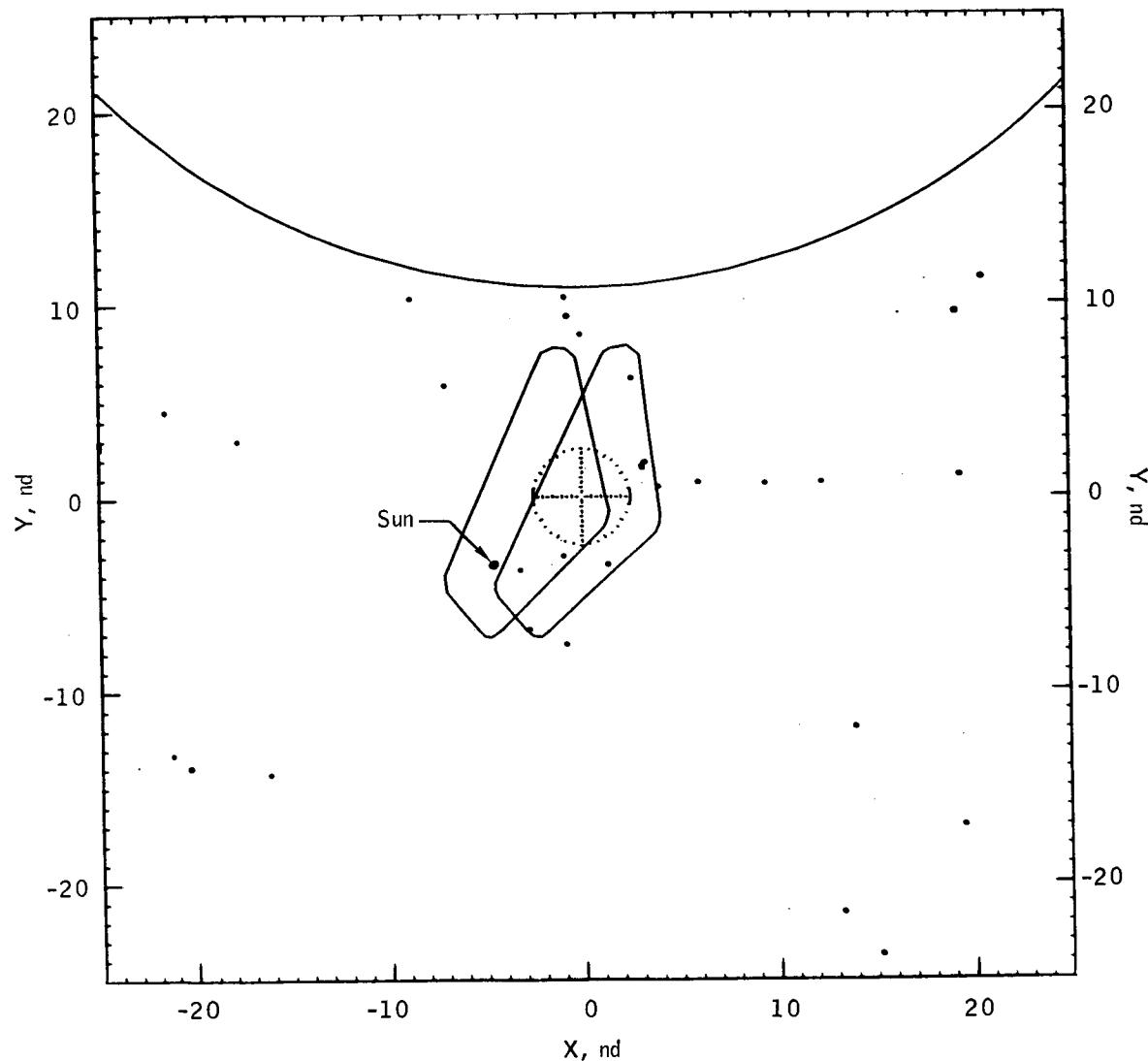


Figure 23c.- Launch date December 21, 1968; 90° launch azimuth; first opportunity.
End of TEI burn.

SEQ	757	759	770	781	789	790	793	794	797	802	803	83A	841
X	19	3	-6	12	3	9	3	-20	6	4	-17	0	1
Y	0	5	-4	11	0	0	0	-3	0	0	2	-3	-4

SEQ	844	861	871	904	907	909	933	1001	1010	1028
X	-2	-2	0	-20	-19	-15	14	13	20	15
Y	-4	-7	-8	-13	-14	-14	-12	-22	-17	-24

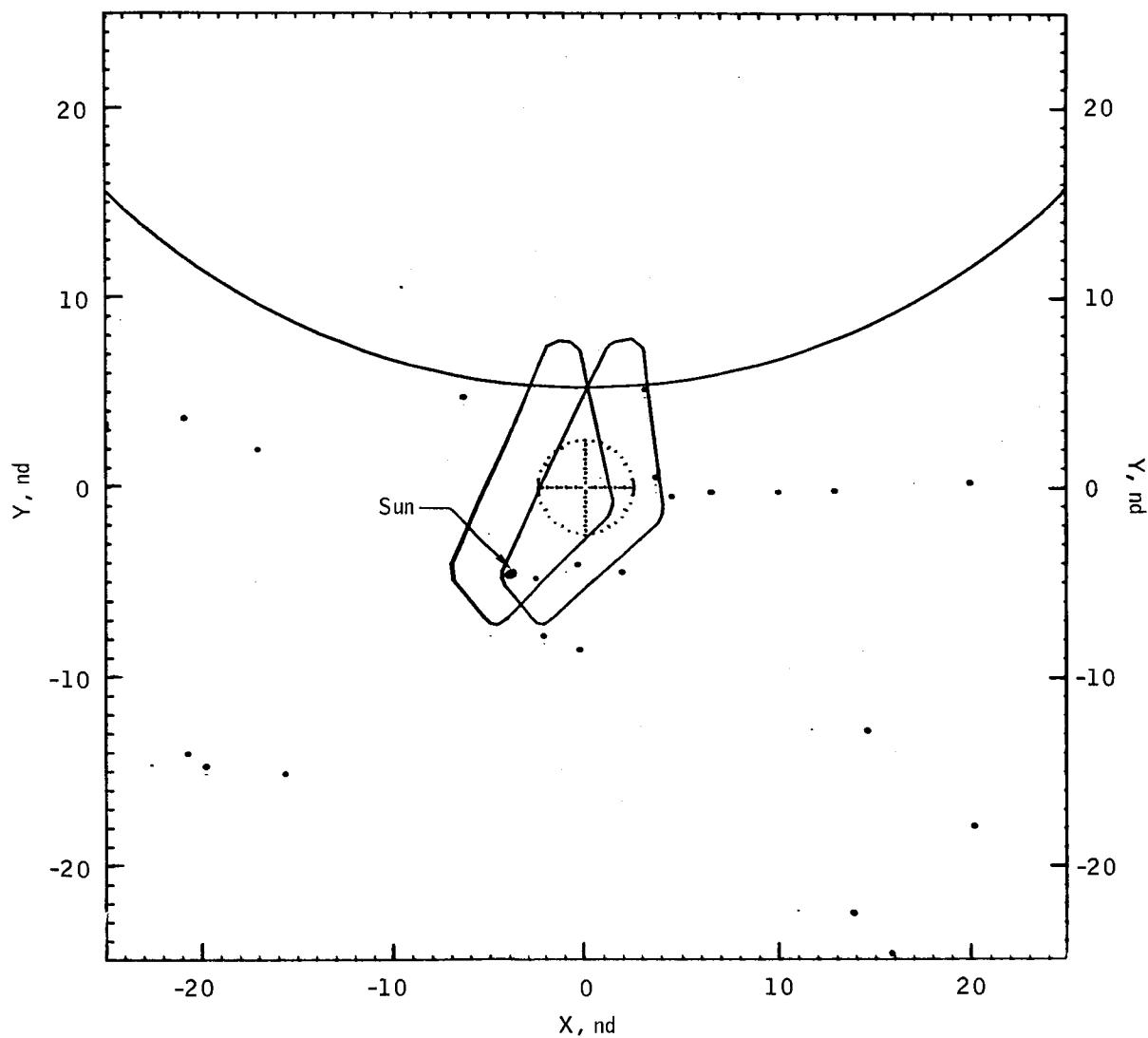


Figure 24a.- Launch date December 21, 1968; 108° launch azimuth; first opportunity.
Beginning of TEI burn.

SEG	643	751	757	759	770	781	785	790	793	795	797	802	803
X	19	0	15	2	-6	12	3	9	3	-21	6	4	-17
Y	8	7	0	5	-4	1	0	0	0	3	0	0	2

SEG	836	841	844	841	871	904	907	909	933	1001	1010	1028	643
X	1	1	*2	-2	0	-21	-20	-16	14	13	19	15	19
Y	-4	-4	-4	-7	-6	-13	-14	-15	-12	-22	-17	-24	8

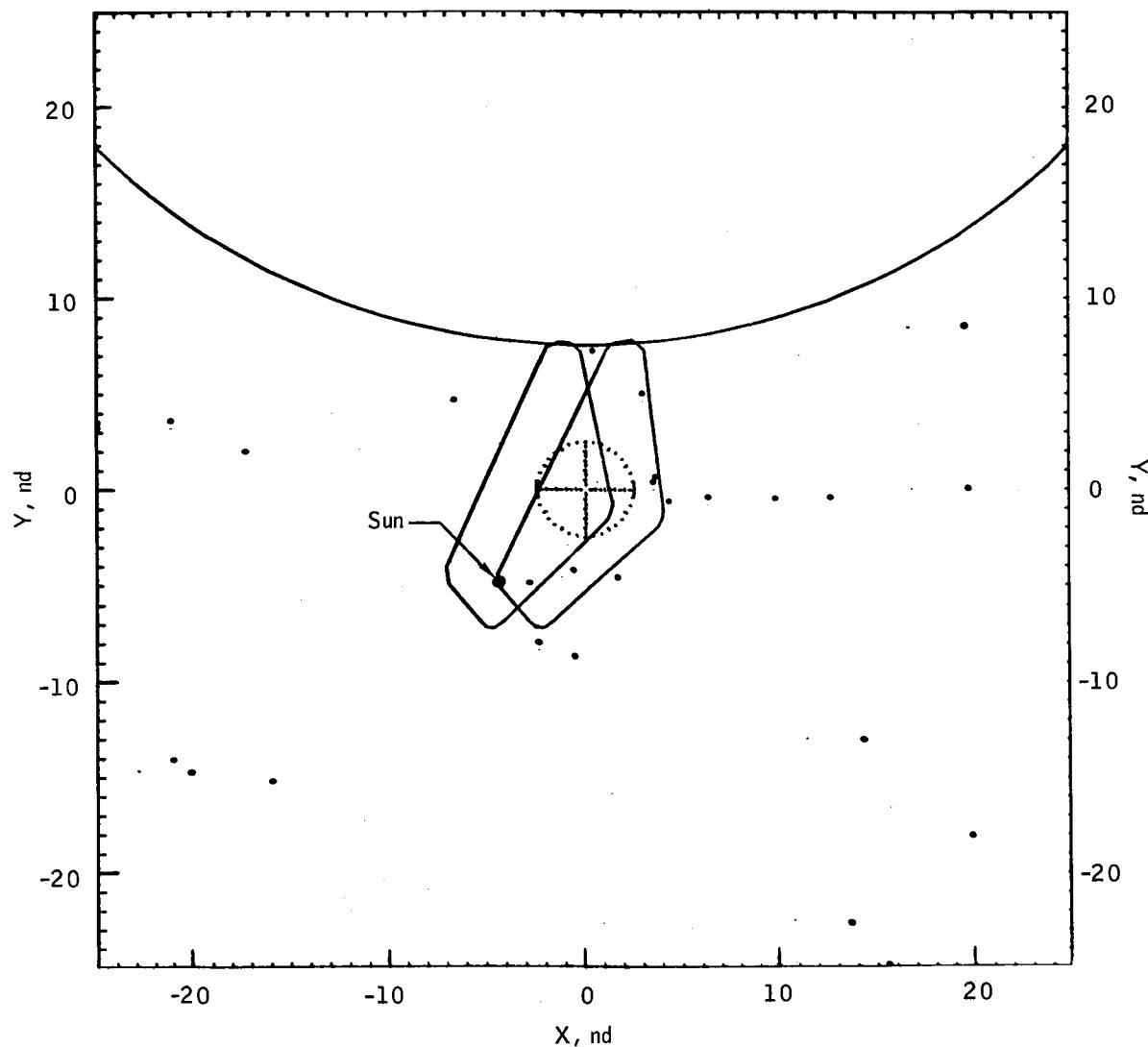


Figure 24b.- Launch date December 21, 1968; 108° launch azimuth; first opportunity.
Middle of TEI burn.

SEQ	617	643	681	738	743	751	753	757	759	770	781	789	790
X	20	19	8	7	6	0	-8	19	2	-7	12	3	9
Y	10	8	16	9	8	7	9	0	5	4	0	0	0
SEQ	793	795	797	802	803	836	841	844	861	871	904	907	
X	3	-21	5	3	-17	0	1	-3	-2	0	-21	-20	
Y	0	3	0	0	2	-4	-4	-4	-7	-8	-13	-14	
SEQ	909	933	1001	1011									
X	-16	13	13	19									
Y	-15	-12	-22	-18									

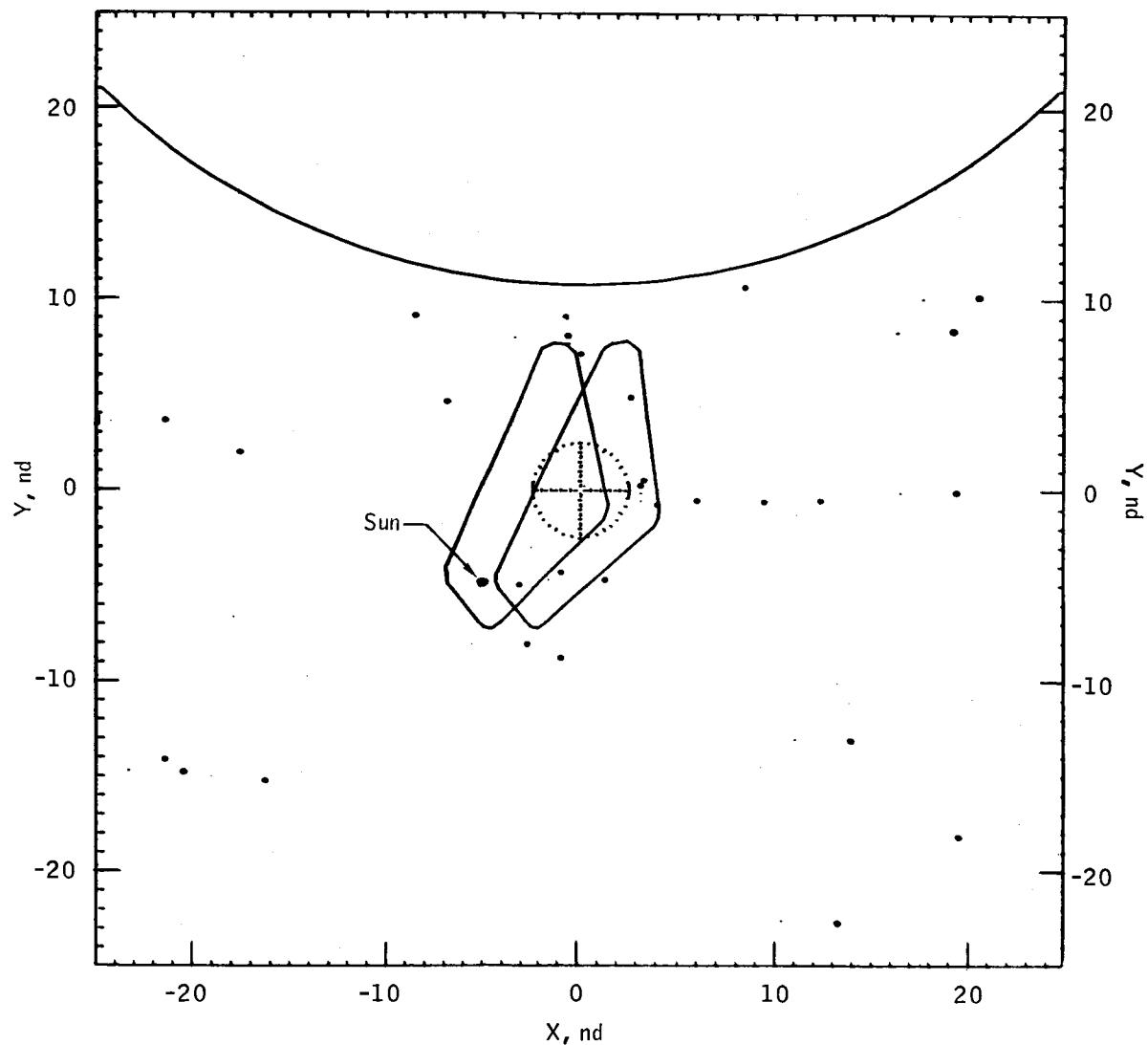


Figure 24c.- Launch date December 21, 1968; 108° launch azimuth; first opportunity.
End of TEI burn.

SEQ	15	861	871	904	907	909	933	984	990	1001	1010	1028	1041
X	19	-1	0	-19	-18	-14	14	-16	-2	12	19	14	7
Y	-22	3	3	-4	-4	-4	-2	-19	-16	-11	-8	-14	-21

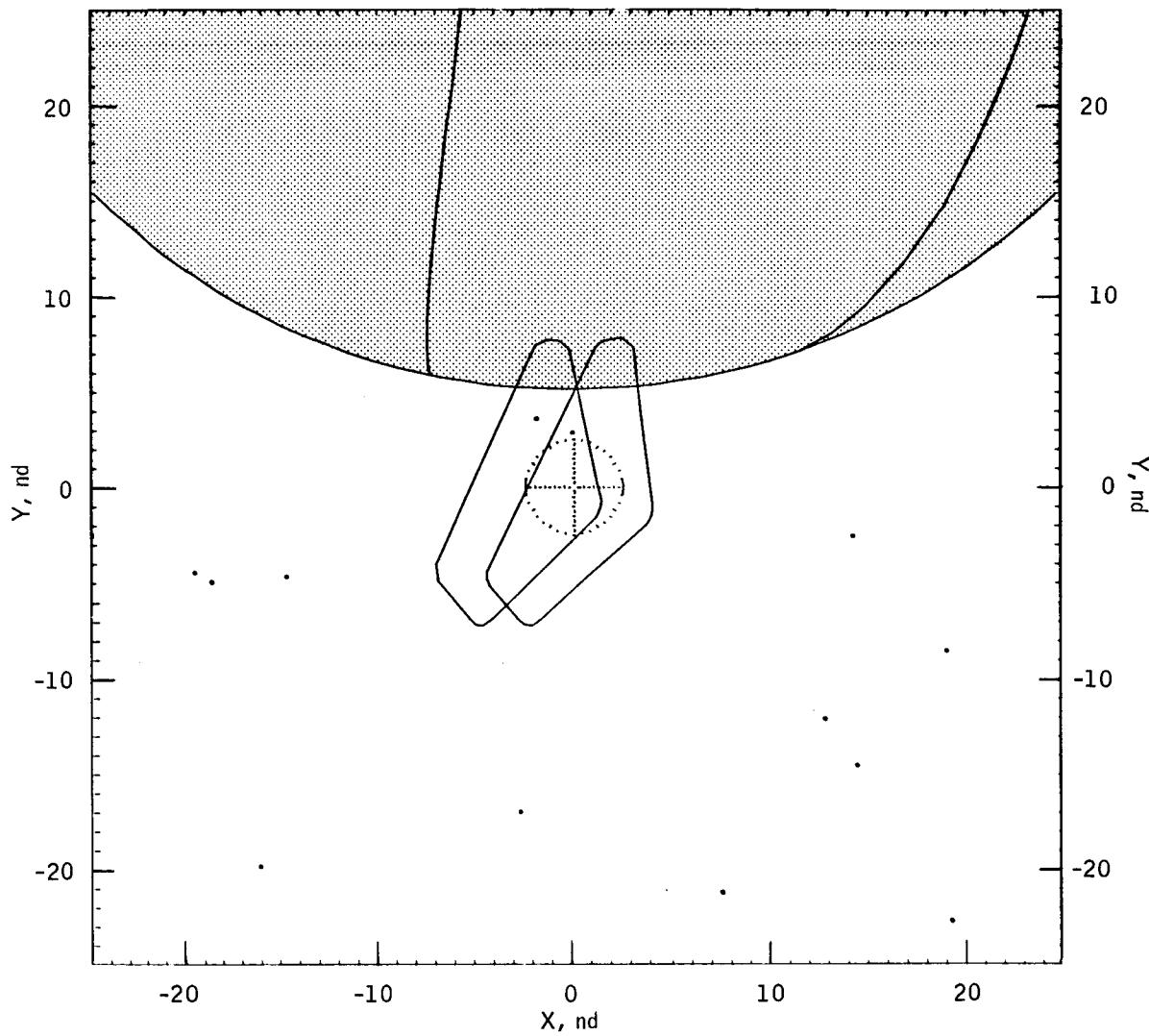


Figure 25a.- Launch date December 23, 1968; 72° launch azimuth; first opportunity.
Beginning of TEI burn.

SF 2	15	-3	3 + 1	+ 5	- 5 + 1	871	924	107	907	933	769	993	1051	1010	1024	1041
A	19		2	- 2	- 2	0	- 19	- 18	- 15	14	- 16	- 3	12	18	14	7
Y	- 22	0	0	5	0	2	- 9	- 4	- 9	- 2	- 19	- 16	- 12	- 6	- 14	- 21

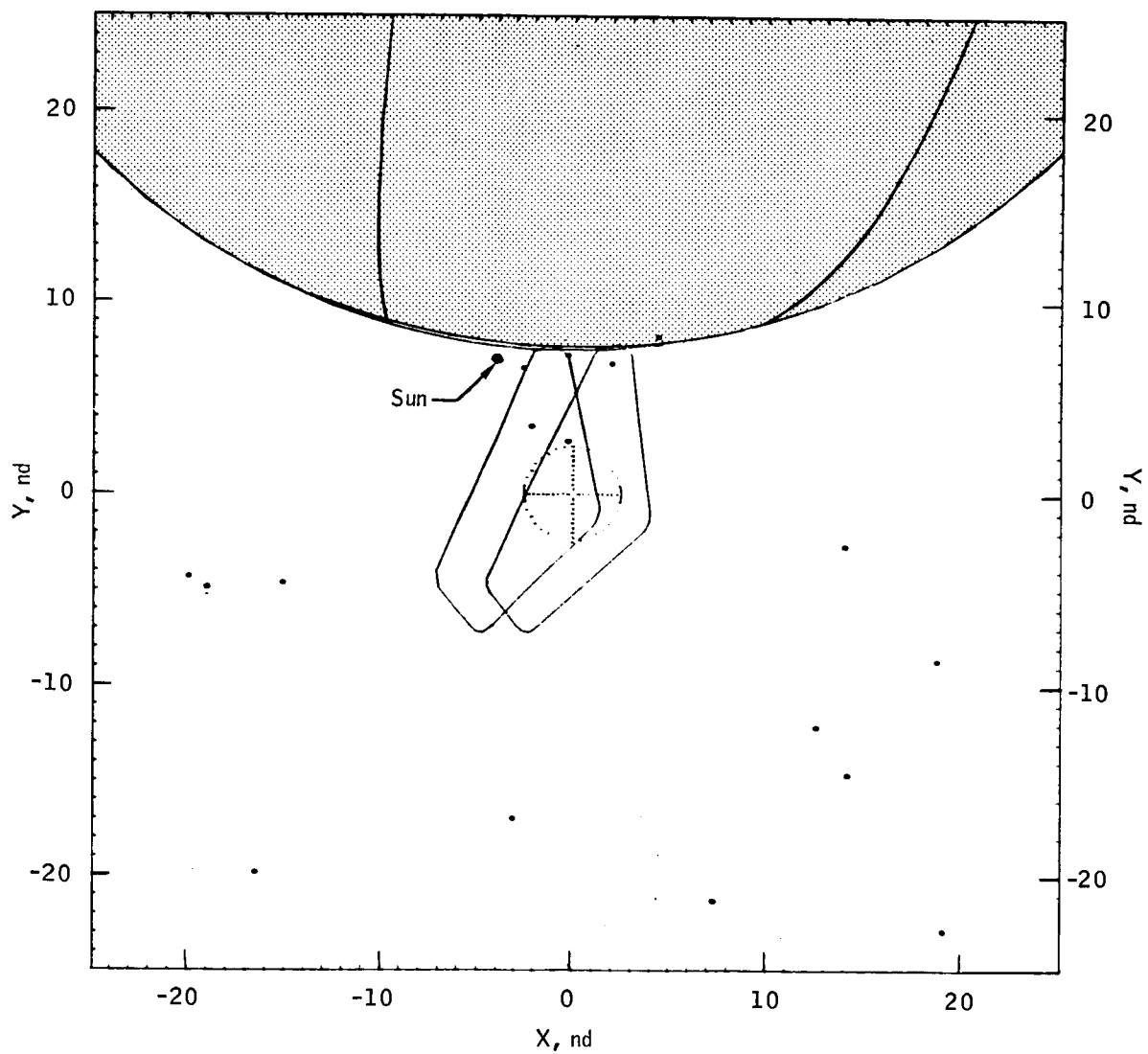


Figure 25b.- Launch date December 23, 1968; 72° launch azimuth; first opportunity.
Middle of TEI burn.

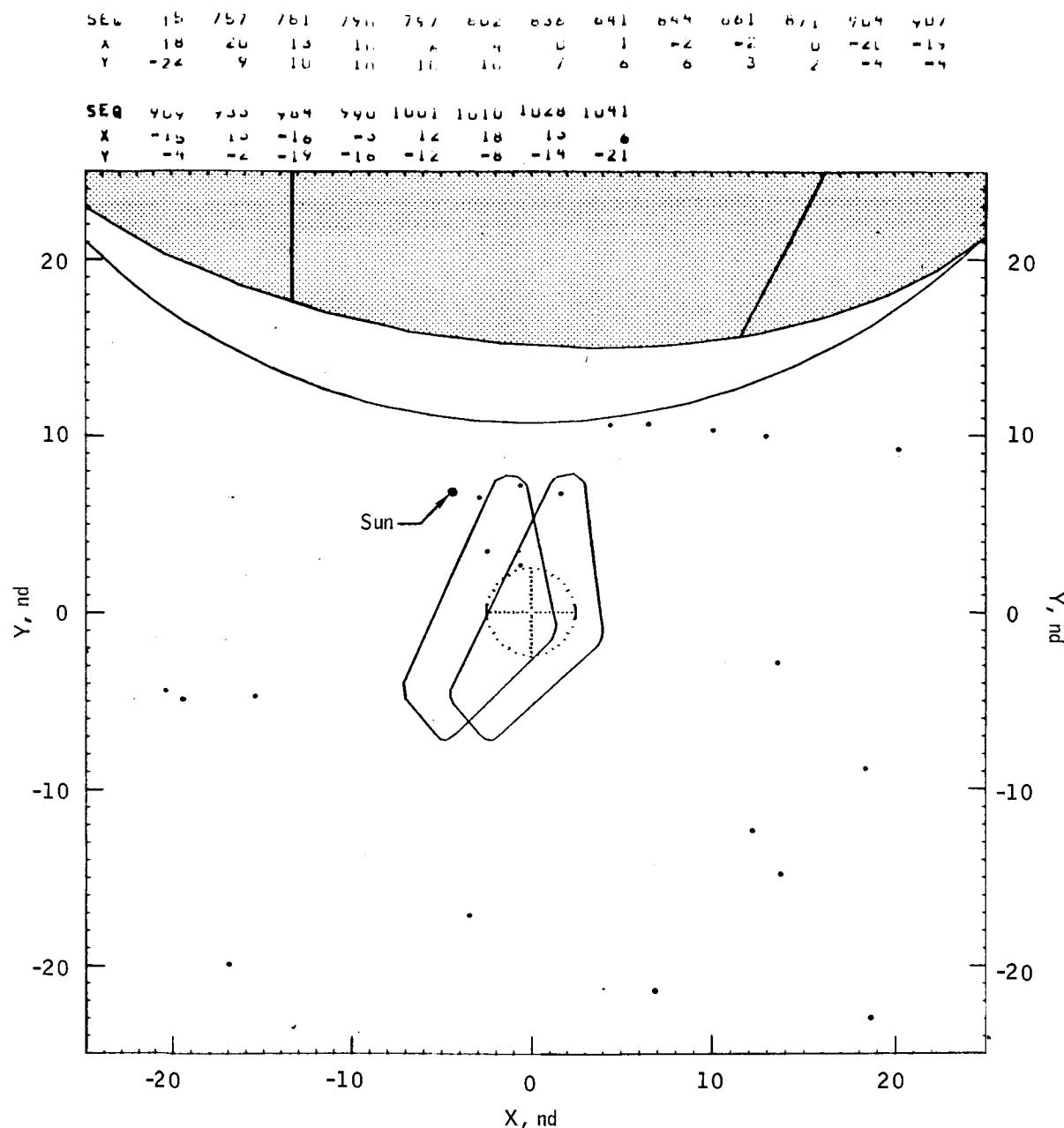


Figure 25c.- Launch date December 23, 1968; 72° launch azimuth; first opportunity.
End of TEI burn.

SEQ	15	861	871	904	907	909	933	984	990	1001	1010	1028	1041
X	19	-1	0	-19	-18	-14	14	-16	-2	12	19	14	7
Y	-23	2	2	-4	-5	-5	-3	-20	-17	-12	-9	-15	-22

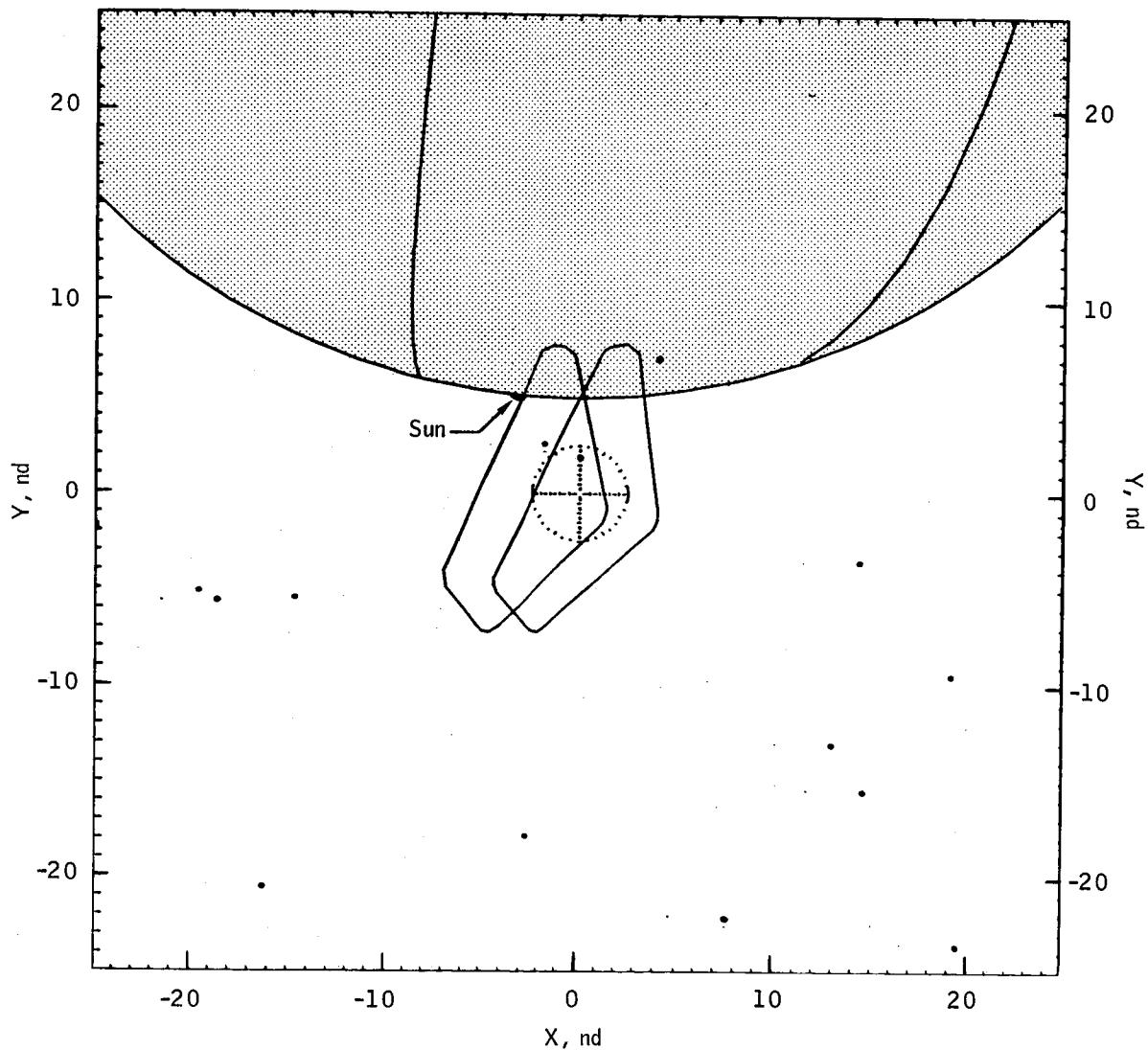


Figure 26a.- Launch date December 23, 1968; 90° launch azimuth; first opportunity.
Beginning of TEI burn.

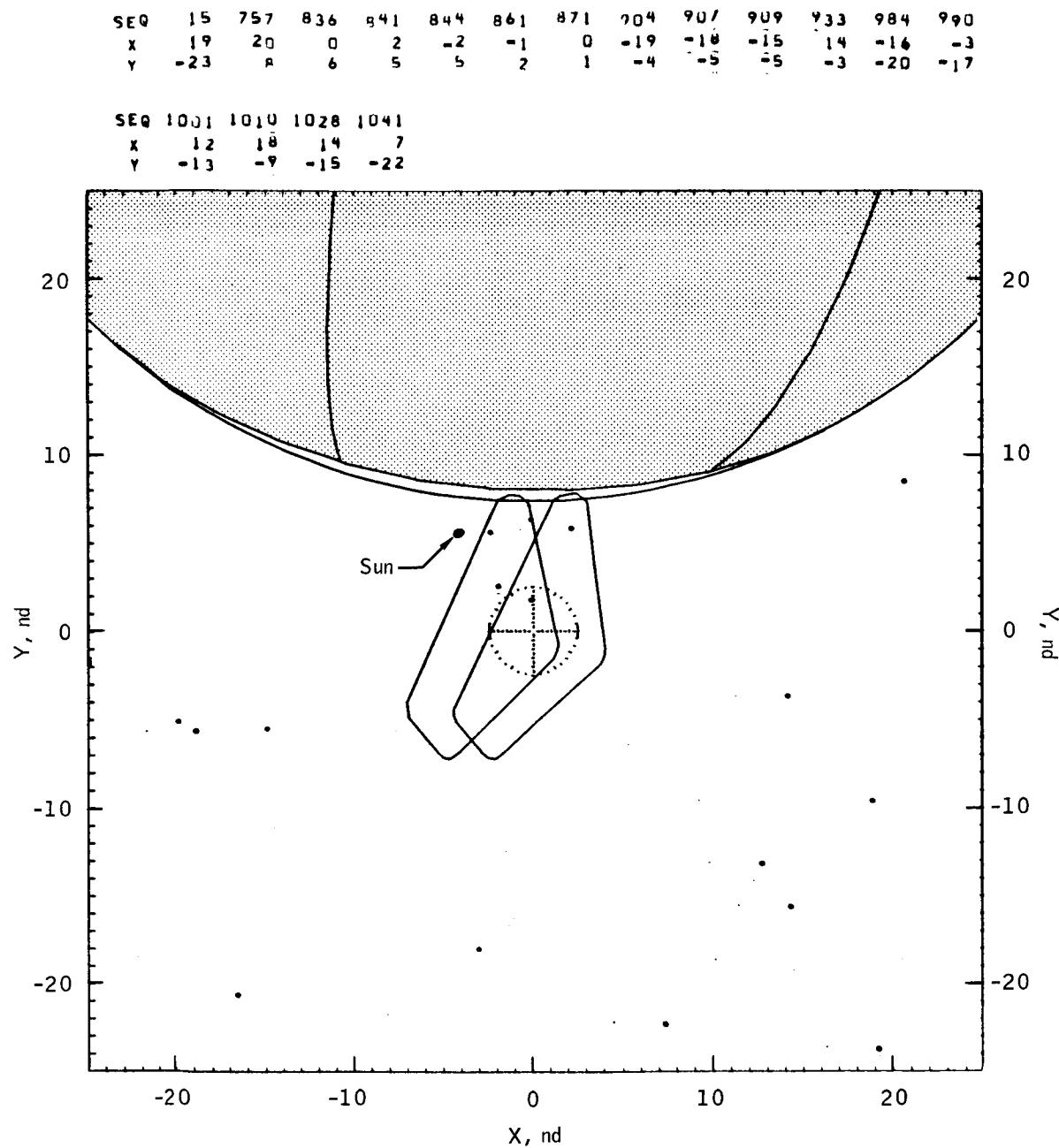


Figure 26b.- Launch date December 23, 1968; 90° launch azimuth; first opportunity.
Middle of TEI burn.

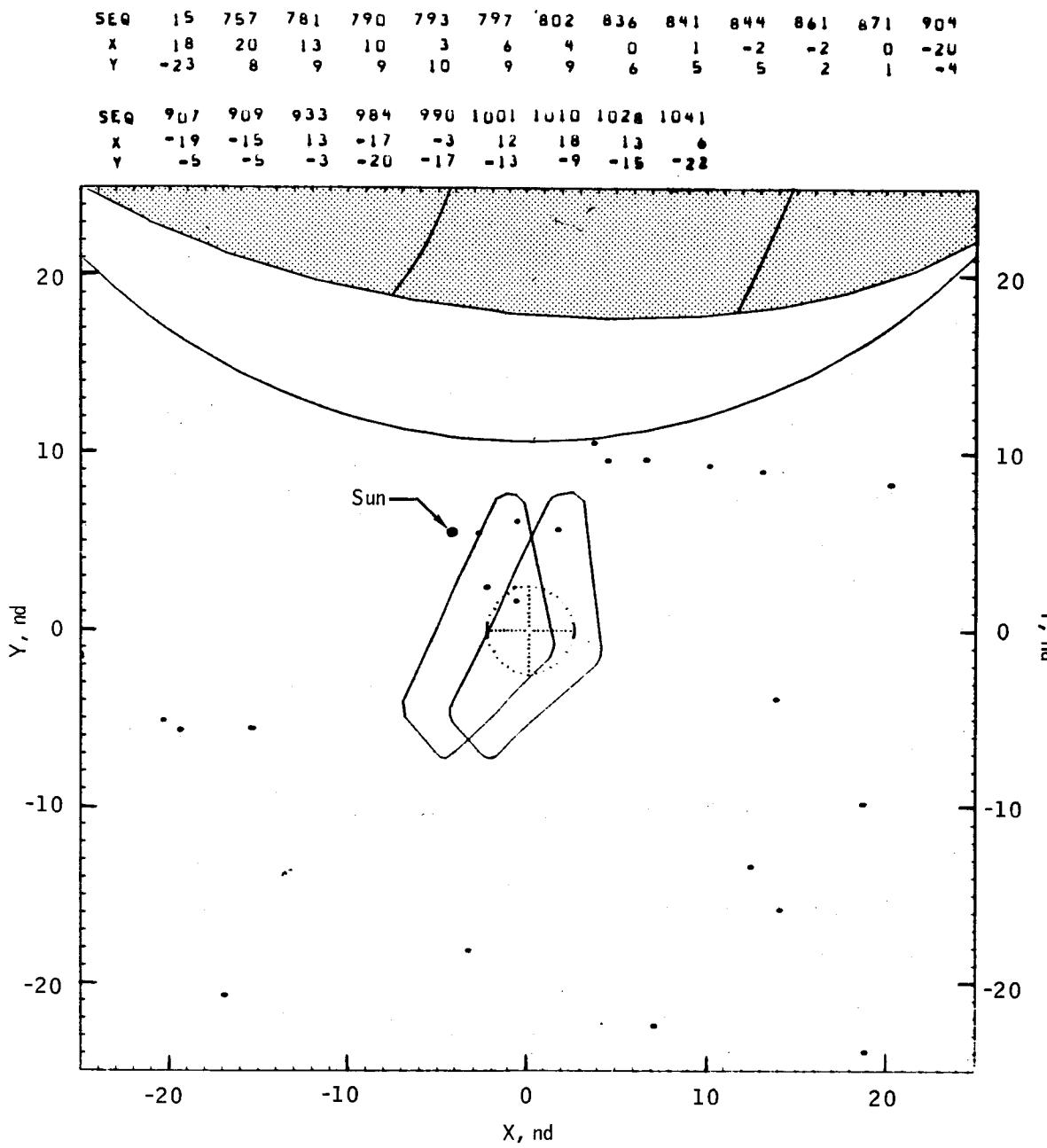


Figure 26c.- Launch date December 23, 1968; 90° launch azimuth; first opportunity.
End of TEI burn.

SEQ	15	641	644	861	871	904	907	909	933	984	990	1001	1010
X	-19	2	-2	-1	0	-19	-18	-14	14	-16	-2	12	19
Y	-24	4	4	1	0	-5	-6	-6	-4	-21	-18	-14	-10

SEQ	1028	1041
X	-14	7
Y	-16	-23

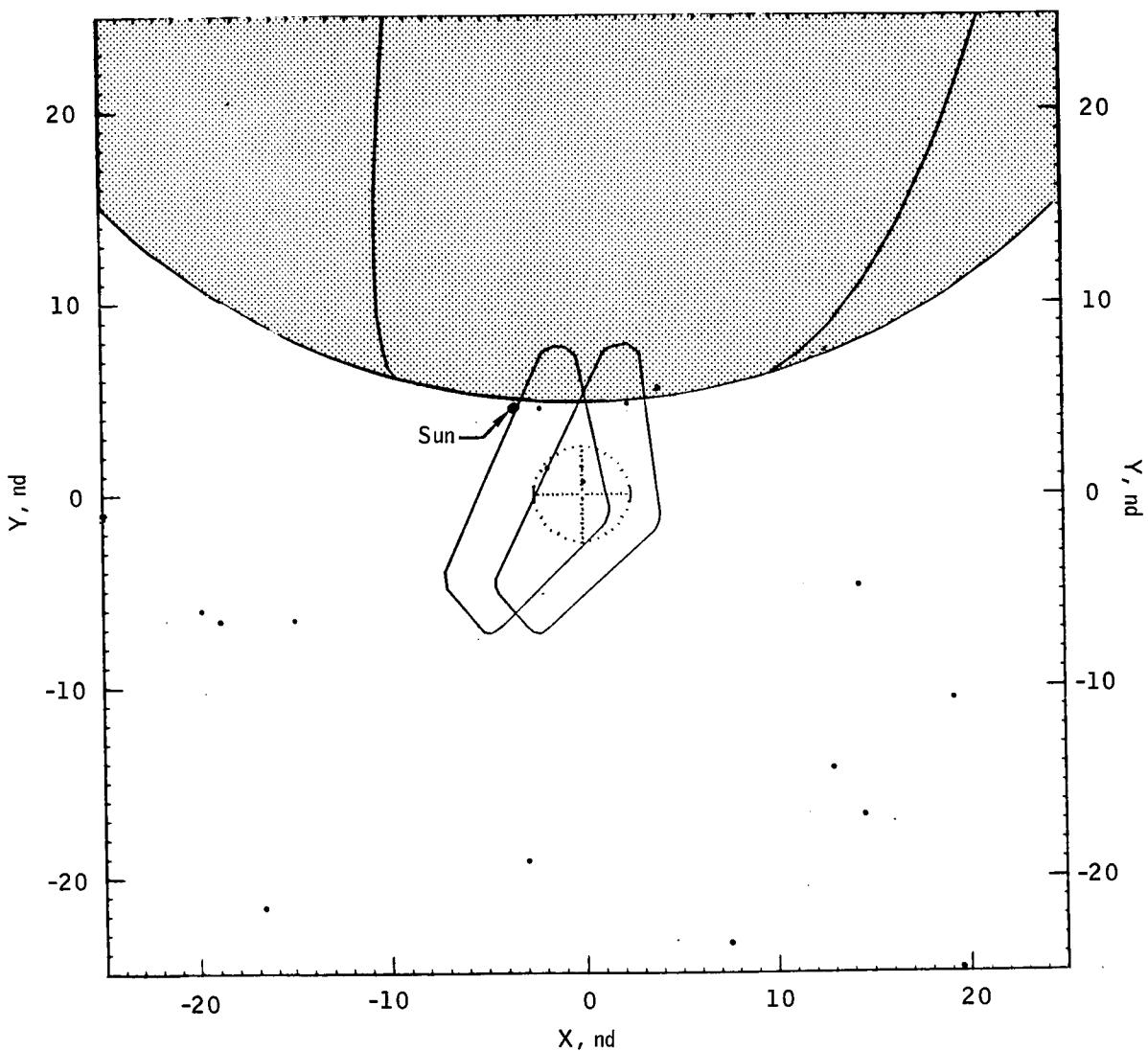


Figure 27a. - Launch date December 23, 1968; 108° launch azimuth; first opportunity.
Beginning of TEI burn.

SEQ	757	836	841	844	861	871	904	907	909	933	984	990	1001	1010
X	20	0	2	-2	-1	0	-19	-19	-15	14	-16	-3	12	18
Y	7	5	4	4	1	0	-5	-6	-6	-4	-21	-19	-14	-10

SEQ 1028 1041

X	14	7
Y	-16	-23

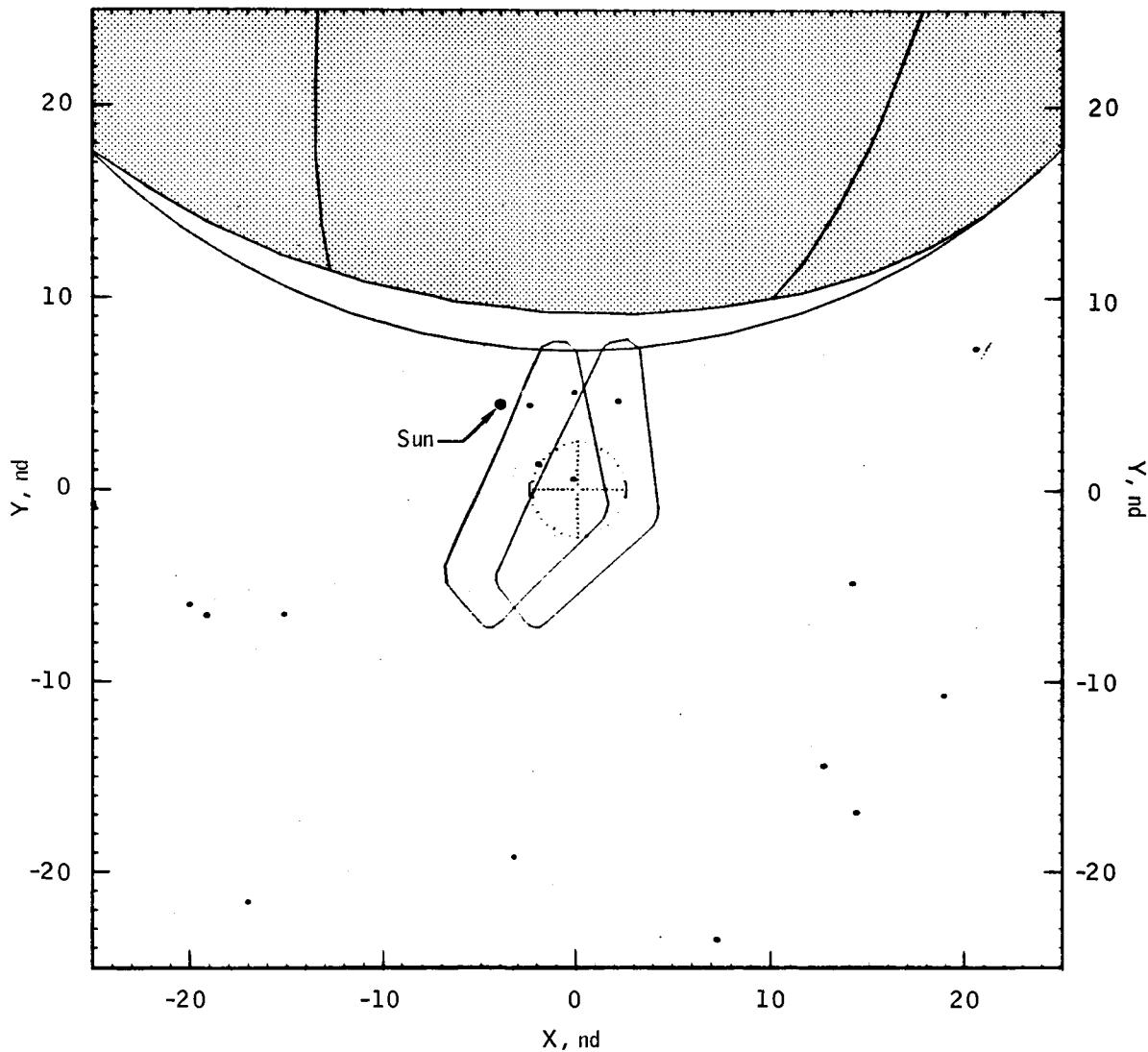


Figure 27b.- Launch date December 23, 1968; 108° launch azimuth; first opportunity.
Middle of TEI burn.

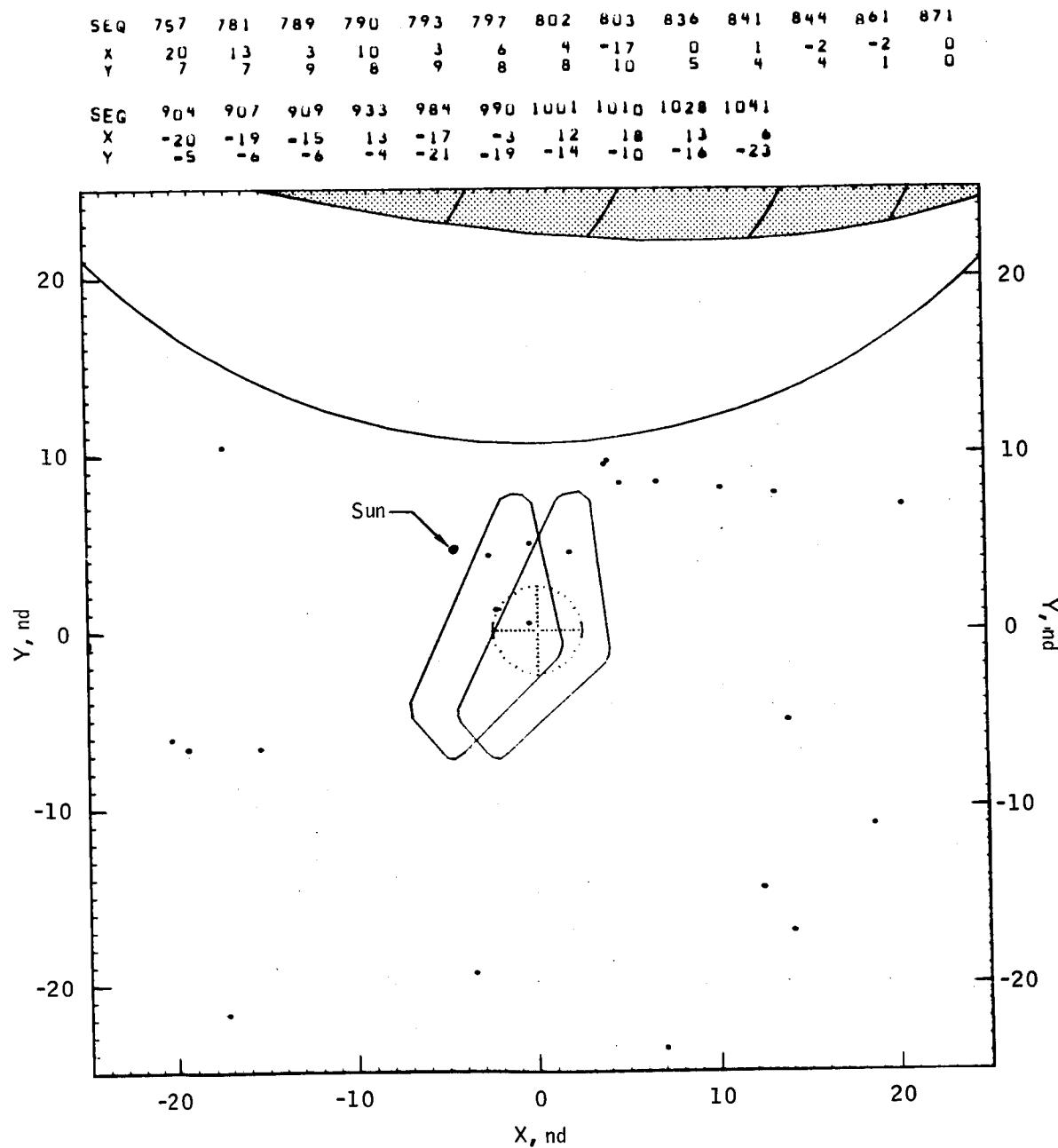


Figure 27c.- Launch date December 23, 1968; 108° launch azimuth; first opportunity.
End of TEI burn.

SEQ	4	7	15	25	984	990	1028	1041	1044	1046
X	-13	-6	20	11	-11	0	16	9	-16	-9
Y	-20	-18	-4	-13	0	4	5	0	-13	-10

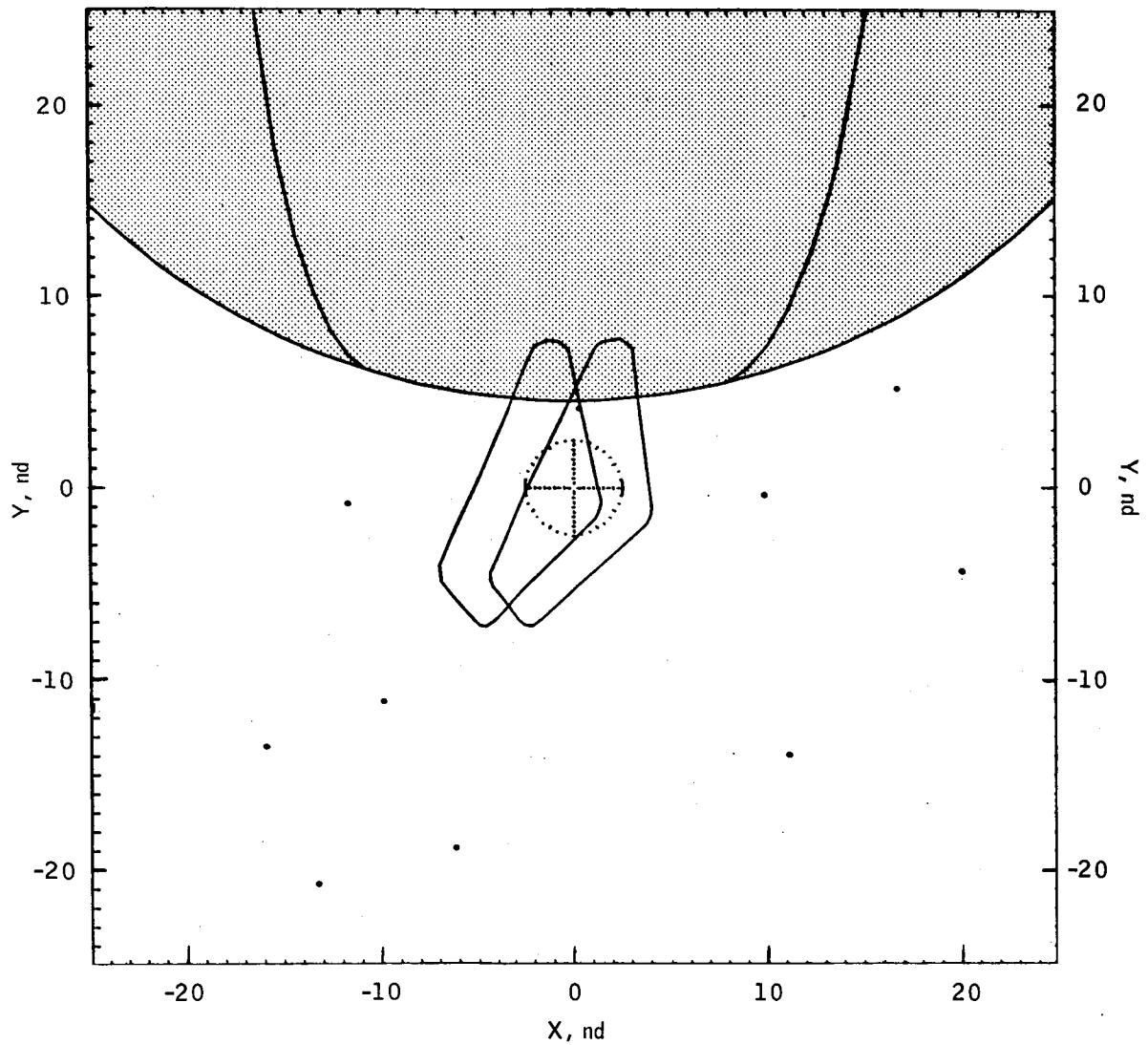


Figure 28a.- Launch date December 27, 1968; 72° launch azimuth; first opportunity.
Beginning of TEI burn.

SEQ	4	7	15	25	984	990	1001	1028	1041	1044	1046
X	-13	-6	19	10	-12	0	16	16	9	-16	-10
Y	-19	-17	-3	-13	0	5	8	5	0	-12	-10

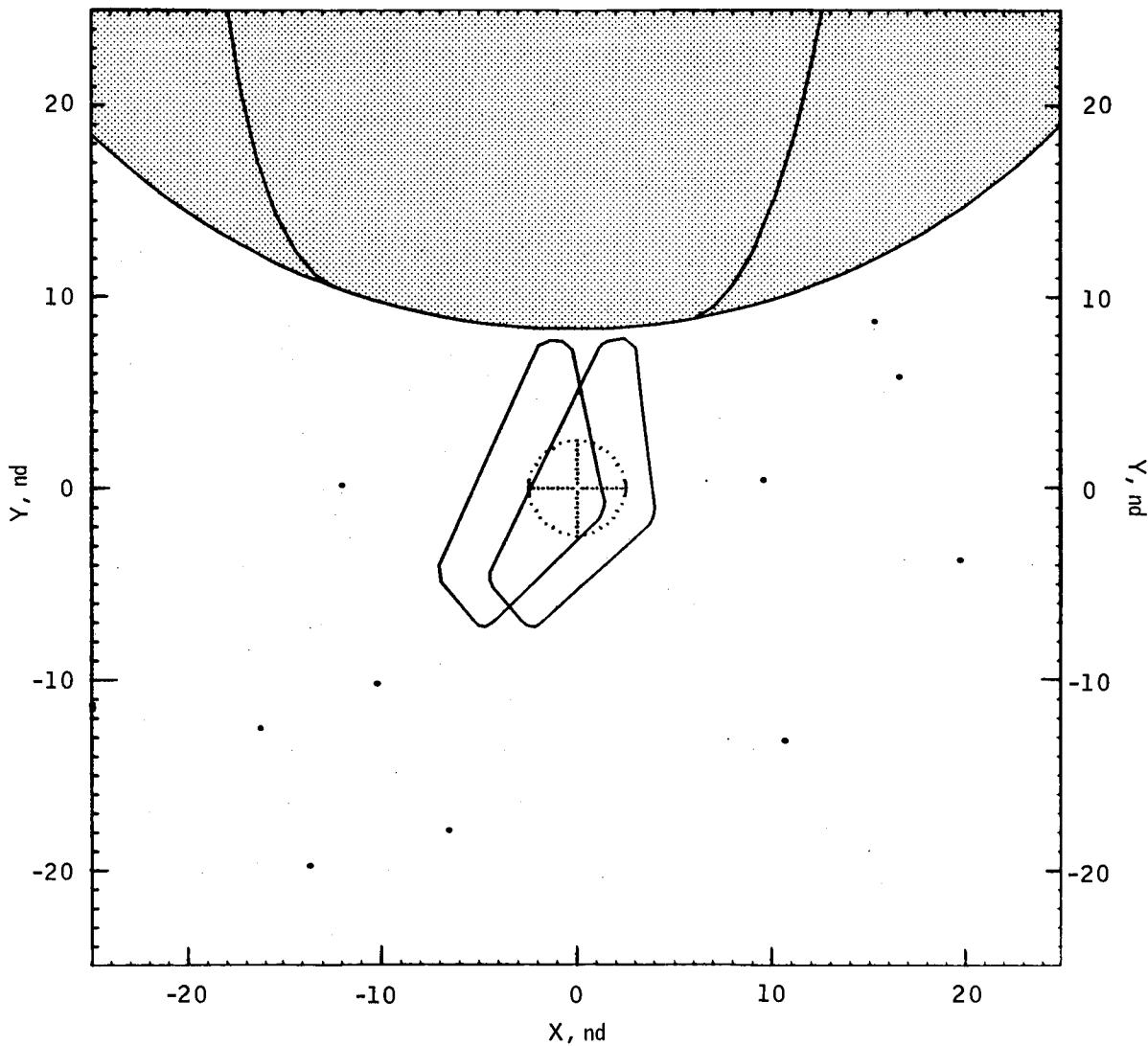


Figure 28b. - Launch date December 27, 1968; 72° launch azimuth; first opportunity.
Middle of TEI burn.

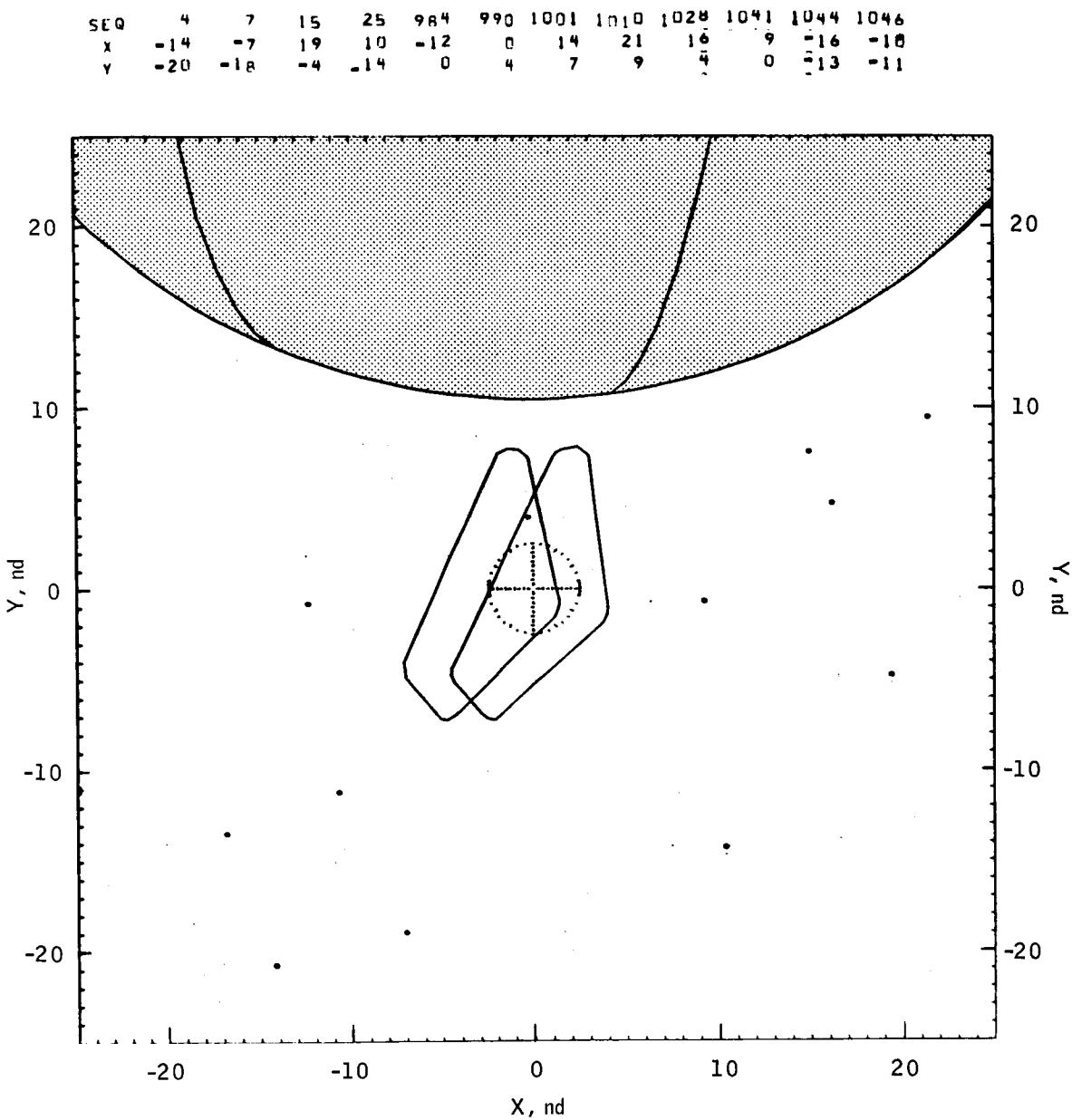


Figure 28c.- Launch date December 27, 1968; 72° launch azimuth; first opportunity.
End of TEI burn.

SEQ	4	7	15	25	984	990	1028	1041	1044	1046
X	-14	-6	19	10	-12	0	16	9	-16	-10
Y	-21	-20	-5	-15	-1	2	3	-1	-14	-12

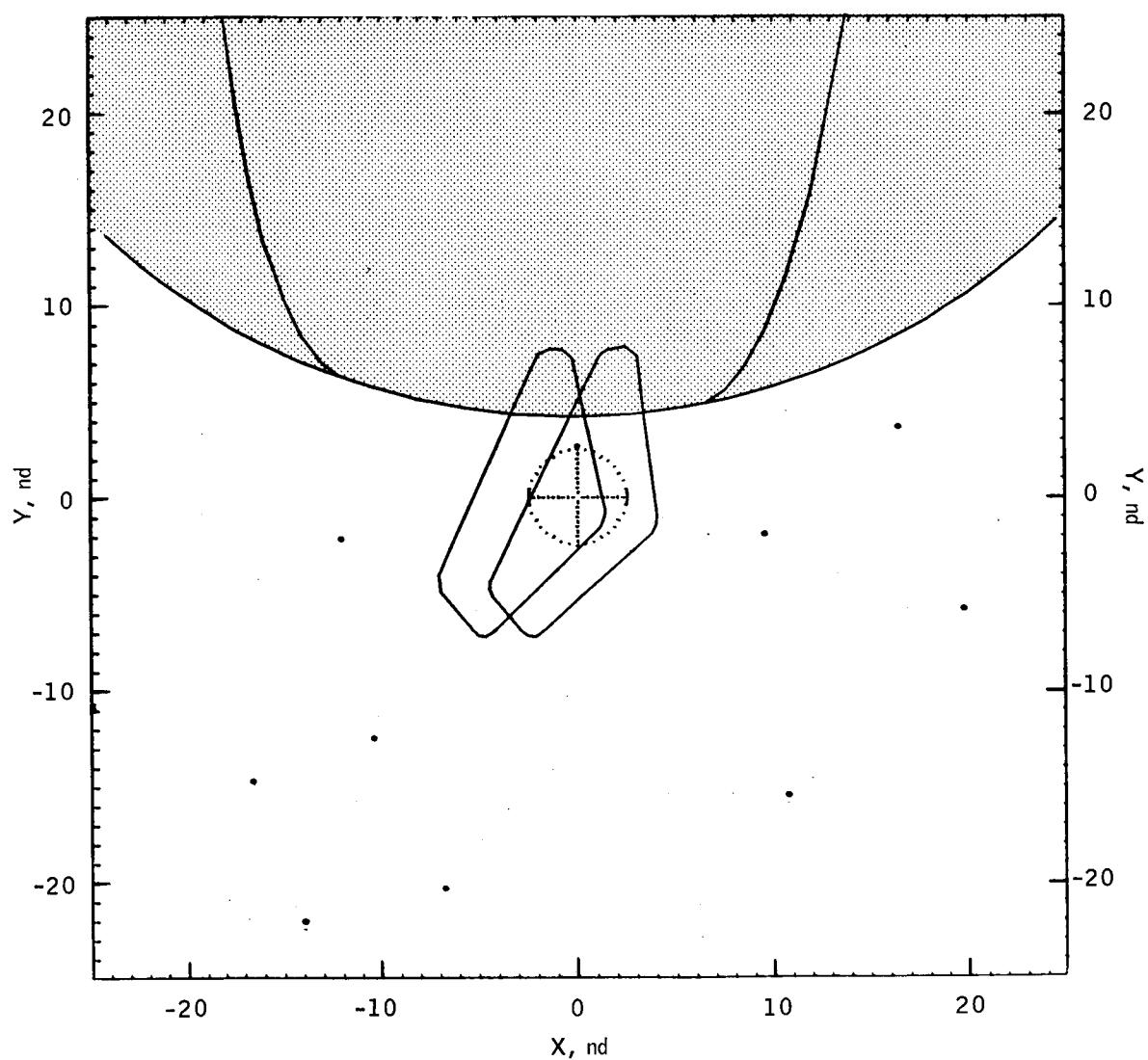


Figure 29a.- Launch date December 27, 1968; 90° launch azimuth; first opportunity.
Beginning of TEI burn.

101

SEQ	4	7	15	25	984	990	1001	1028	1041	1044	1046
X	-14	-7	19	10	-12	0	14	16	9	-16	-10
Y	-21	-20	-5	-15	-1	2	8	3	-1	-14	-12

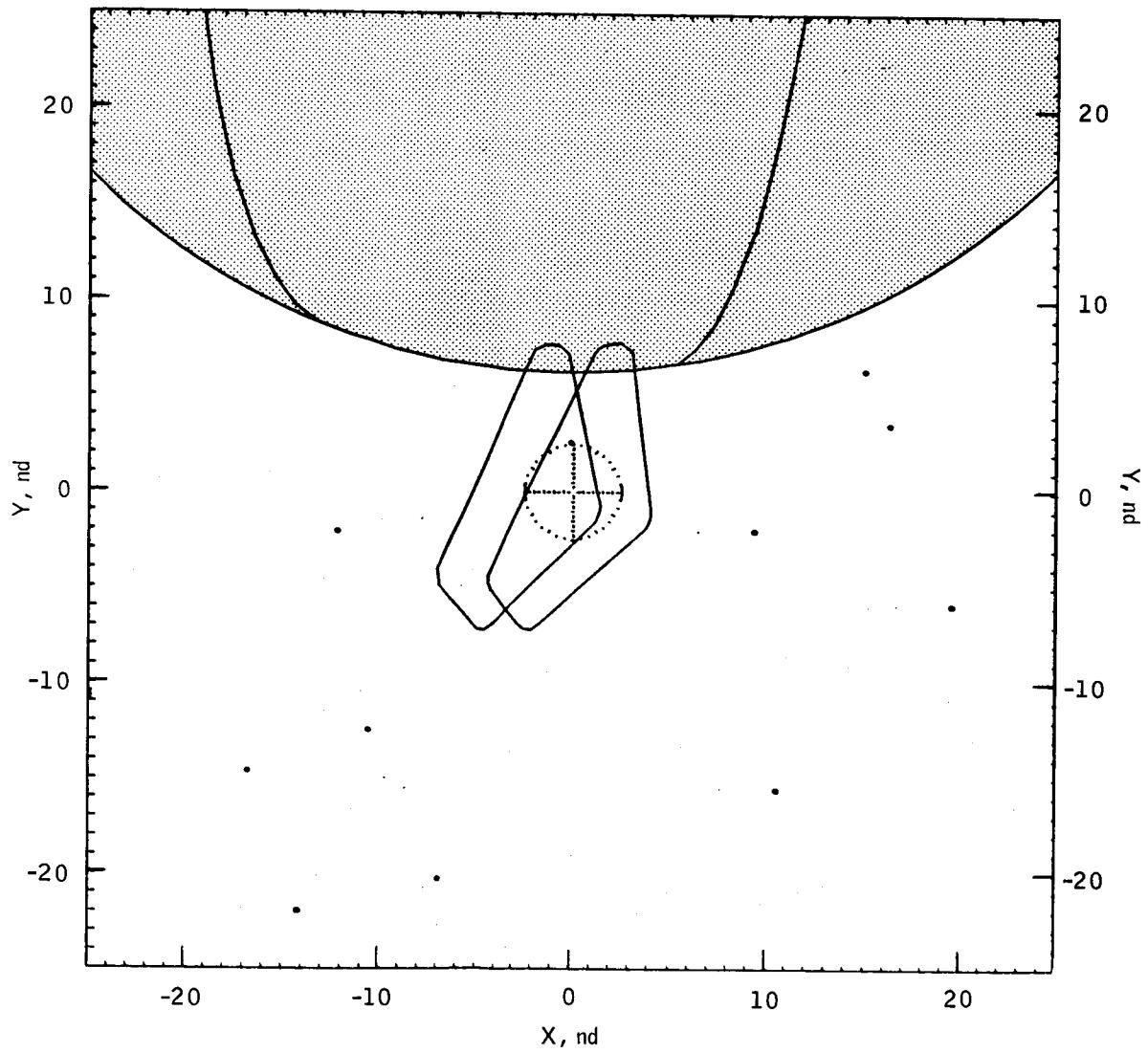


Figure 29b.- Launch date December 27, 1968; 90° launch azimuth; first opportunity.
Middle of TEI burn.

102

SEQ	4	7	15	25	984	990	1001	1010	1028	1041	1044	1046
x	-14	-7	19	10	-12	0	14	21	15	8	-17	-11
y	-21	-20	-6	-15	-1	2	6	8	3	-2	-14	-12

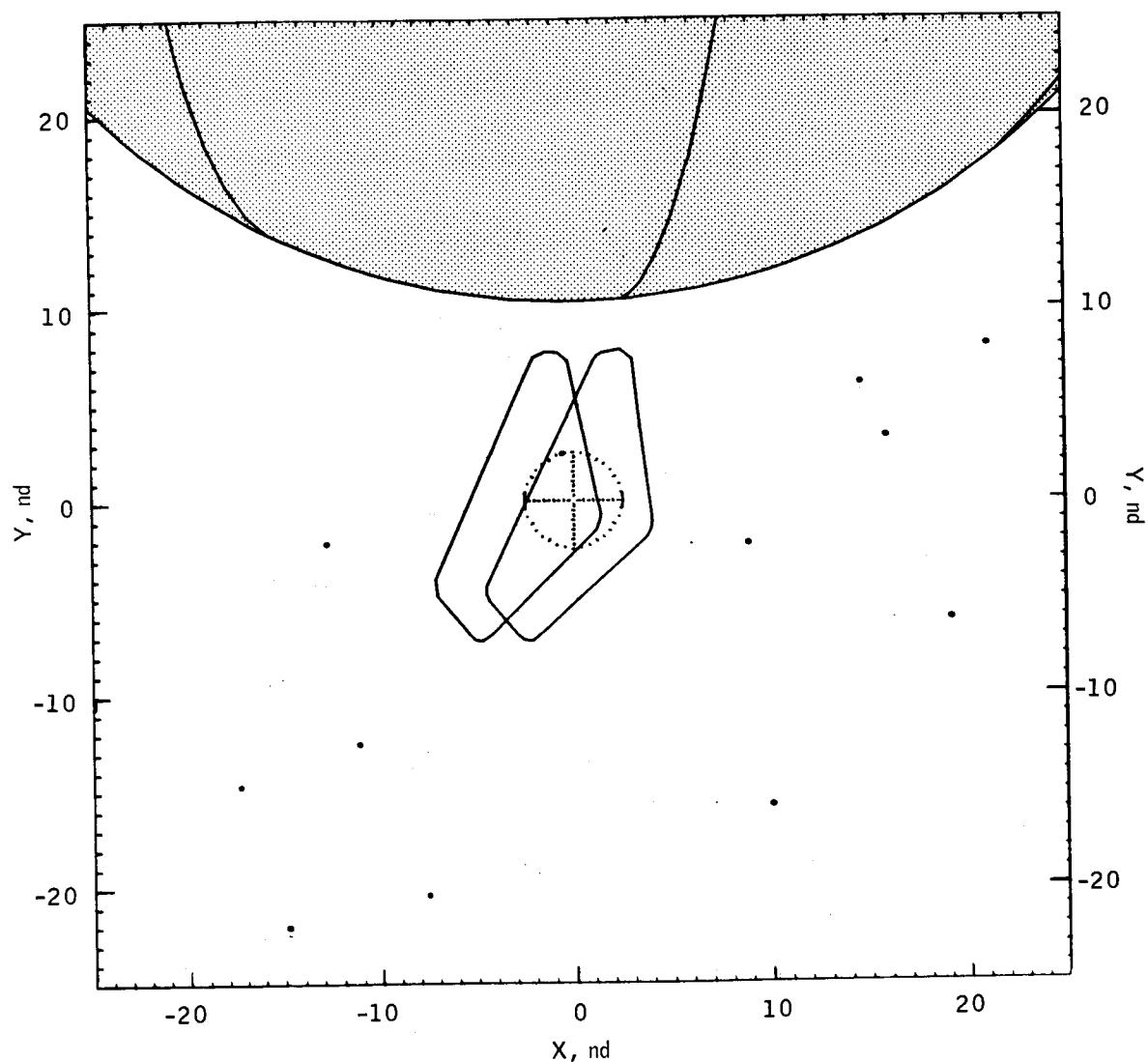


Figure 29c.- Launch date December 27, 1968; 90° launch azimuth; first opportunity
End of TEI burn.

SEQ	4	7	15	25	984	990	1028	1041	1044	1046
X	-14	-7	19	10	-12	0	16	9	-17	-10
Y	-22	-20	-6	-16	-2	2	3	-2	-15	-12

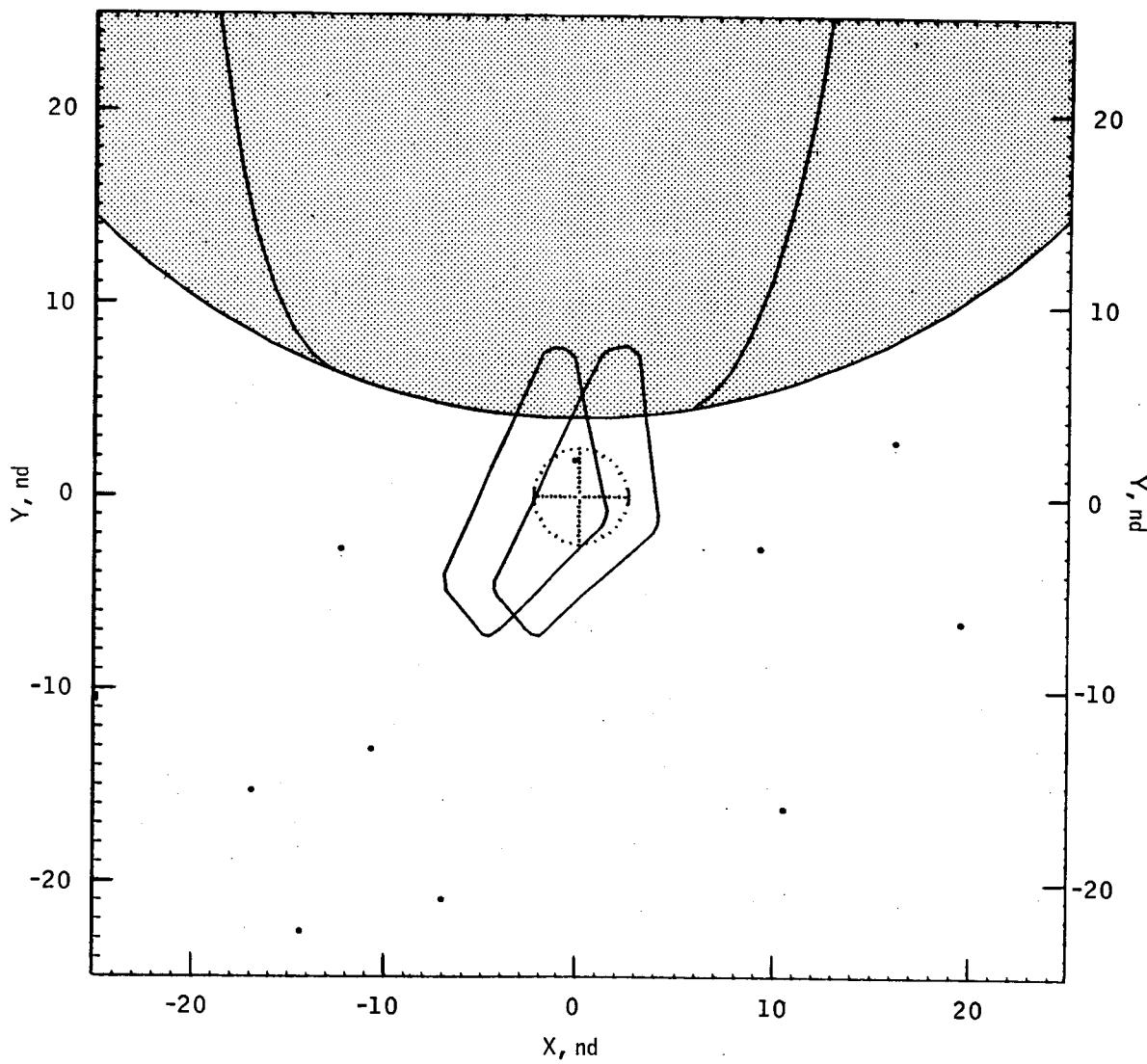


Figure 30a.- Launch date December 27, 1968; 108° launch azimuth; first opportunity.
Beginning of TEI burn.

104

SEQ	4	7	15	25	984	990	1001	1010	1028	1041	1044	1046
X	-14	-7	19	10	-12	0	14	21	15	9	-17	-11
Y	-22	-20	-6	-16	-2	1	5	7	2	-2	-15	-12

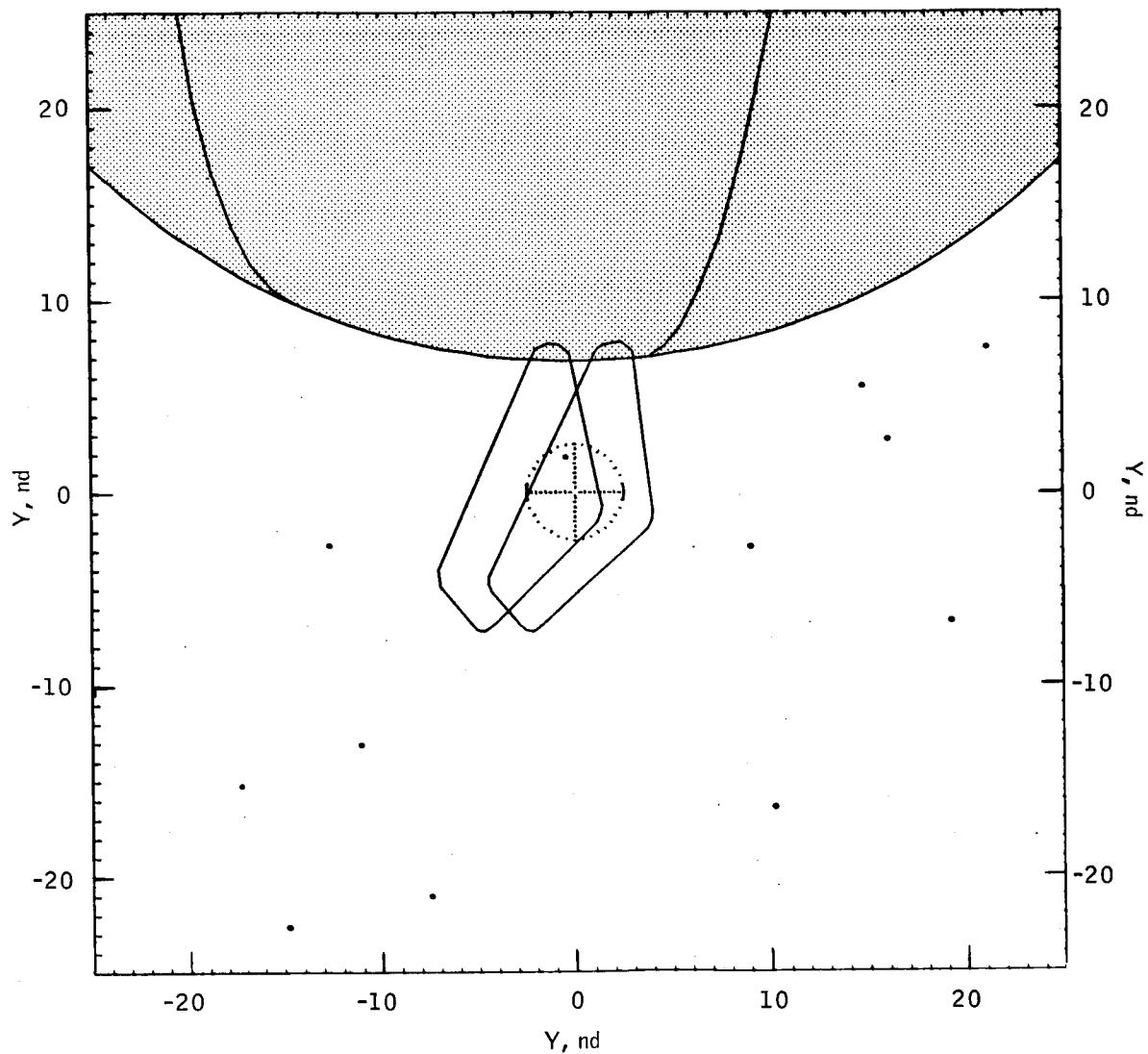


Figure 30b.- Launch date December 27, 1968; 108° launch azimuth; first opportunity.
Middle of TEI burn.

SEQ	4	7	15	25	984	990	1001	1010	1028	1041	1044	1046
X	-15	-7	18	9	-13	0	14	20	15	8	-17	-14
Y	+22	-20	-6	-16	-2	1	5	7	2	-2	-15	-13

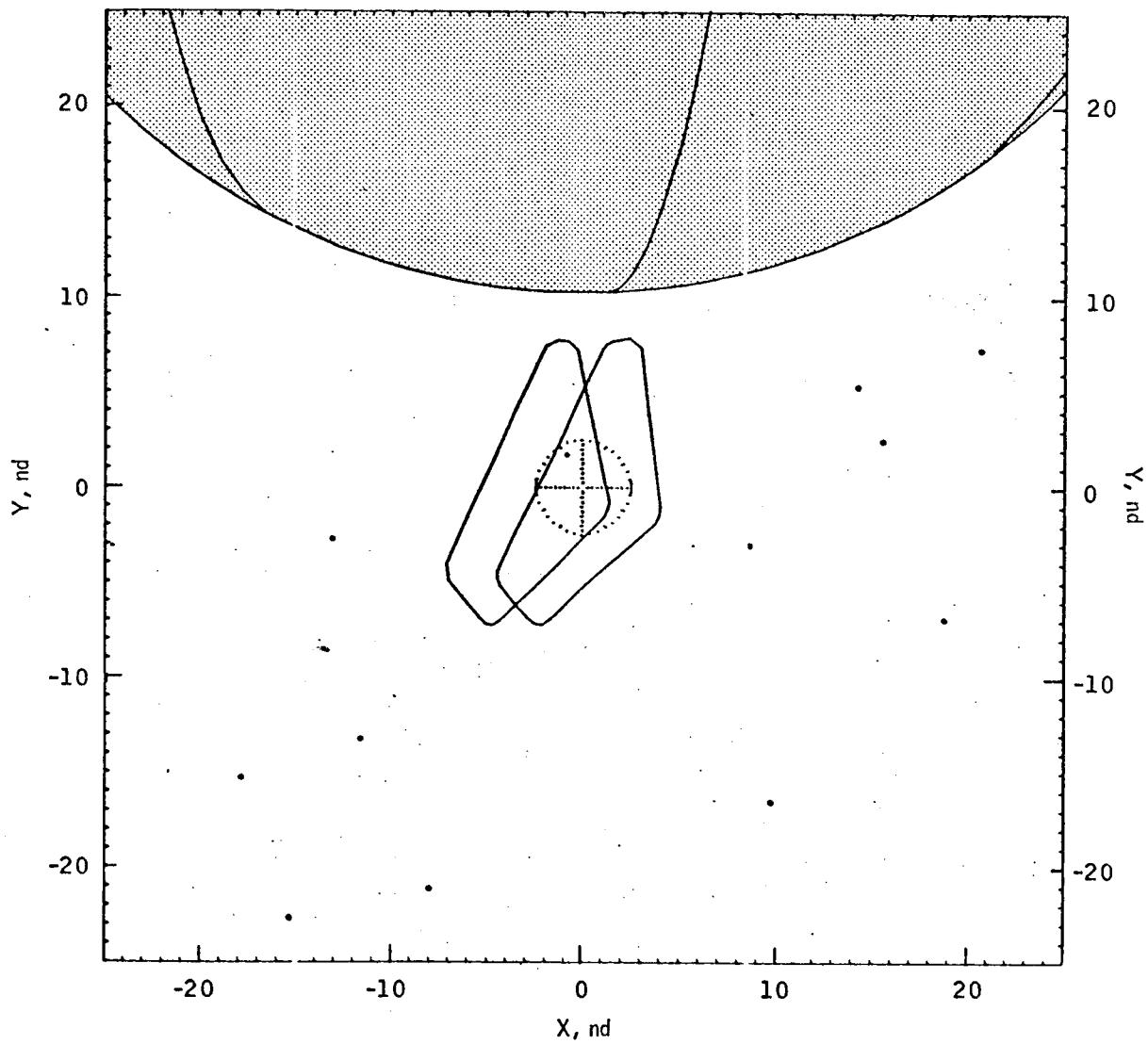


Figure 30c.- Launch date December 27, 1968; 108° launch azimuth; first opportunity.
End of TEI burn.

106

SEQ	4	5	22	31	41	47	63	73	75	80	108	111	112
X	-15	24	22	22	13	20	3	12	4	-8	-8	7	8
Y	-21	-7	-7	-5	-15	-4	-16	-8	-14	-19	-12	-9	-3
SEG	120	144	150	151	186	205	207	215	221	222	230	231	
X	11	0	2	6	-6	1	6	-17	-19	7	-12	-1	
Y	0	-3	-1	0	0	4	6	1	1	7	4	7	
SEQ	237	239	245	246	248	252	256	265	270	271	281		
X	-16	-24	-19	-16	-5	-17	-21	-12	6	2	-5		
Y	5	2	4	5	8	5	5	8	11	11	12		

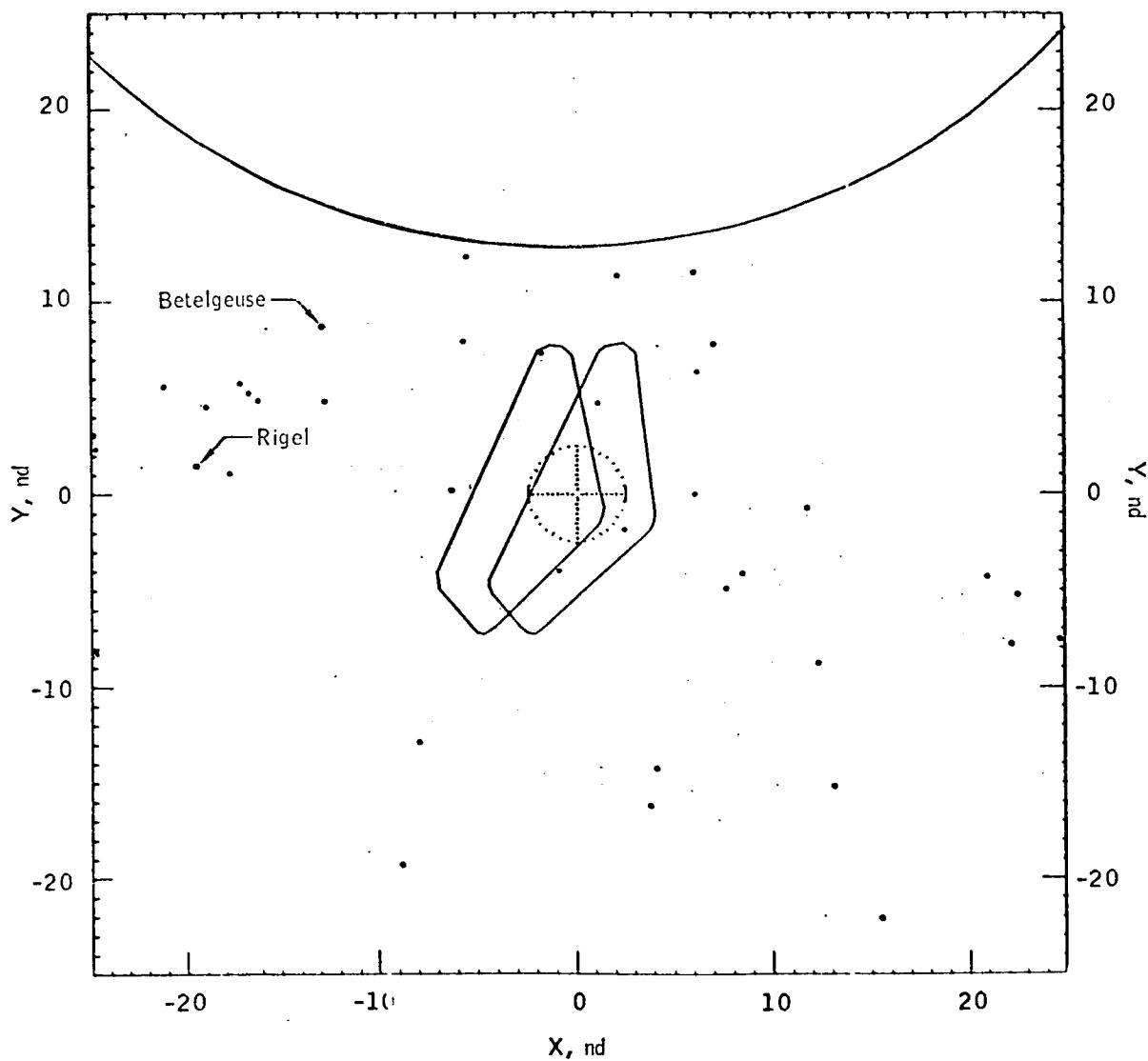


Figure 31a.- Launch date December 21, 1968; 72° launch azimuth; second opportunity.
Beginning of LOI burn.

SEQ	4	22	31	41	47	63	73	75	80	108	111	118	120
X	16	23	23	14	21	4	13	5	-7	-6	8	9	12
Y	-21	-6	-4	-14	-3	-15	-7	-13	-18	-12	-3	-3	0

SEG	144	150	151	186	205	207	215	221	222	230	231	237
X	0	3	7	-5	1	7	-16	-18	7	-11	0	-15
Y	-3	0	0	1	5	7	1	2	8	5	8	5

SEQ	239	245	246	252	256
X	-23	-18	-15	-16	-20
Y	2	5	5	6	6

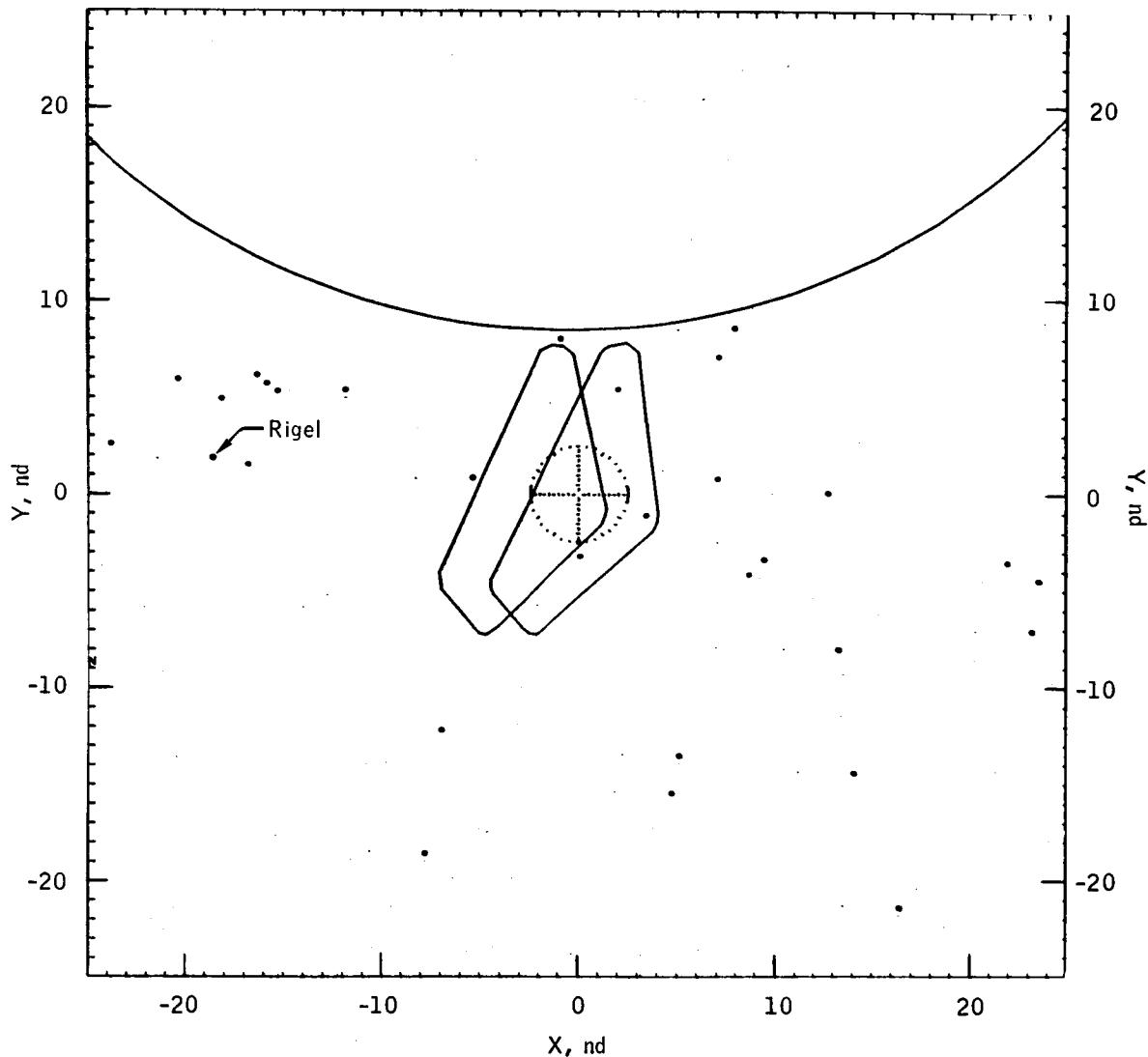


Figure 31b.- Launch date December 21, 1968; 72° launch azimuth; second opportunity.
Middle of LOI burn

SEQ	4	41	47	63	73	75	80	108	111	112	120	140	150
X	18	16	23	6	15	7	-5	-6	10	11	14	1	5
Y	-21	-14	-3	-15	-7	-13	-18	-12	-3	-3	0	-3	0

SEG	151	186	215	221	230	233	237	239	245	246	256
X	8	-3	-15	-16	-10	-23	-13	-22	-16	-14	-18
Y	1	0	1	1	5	1	5	2	4	5	5

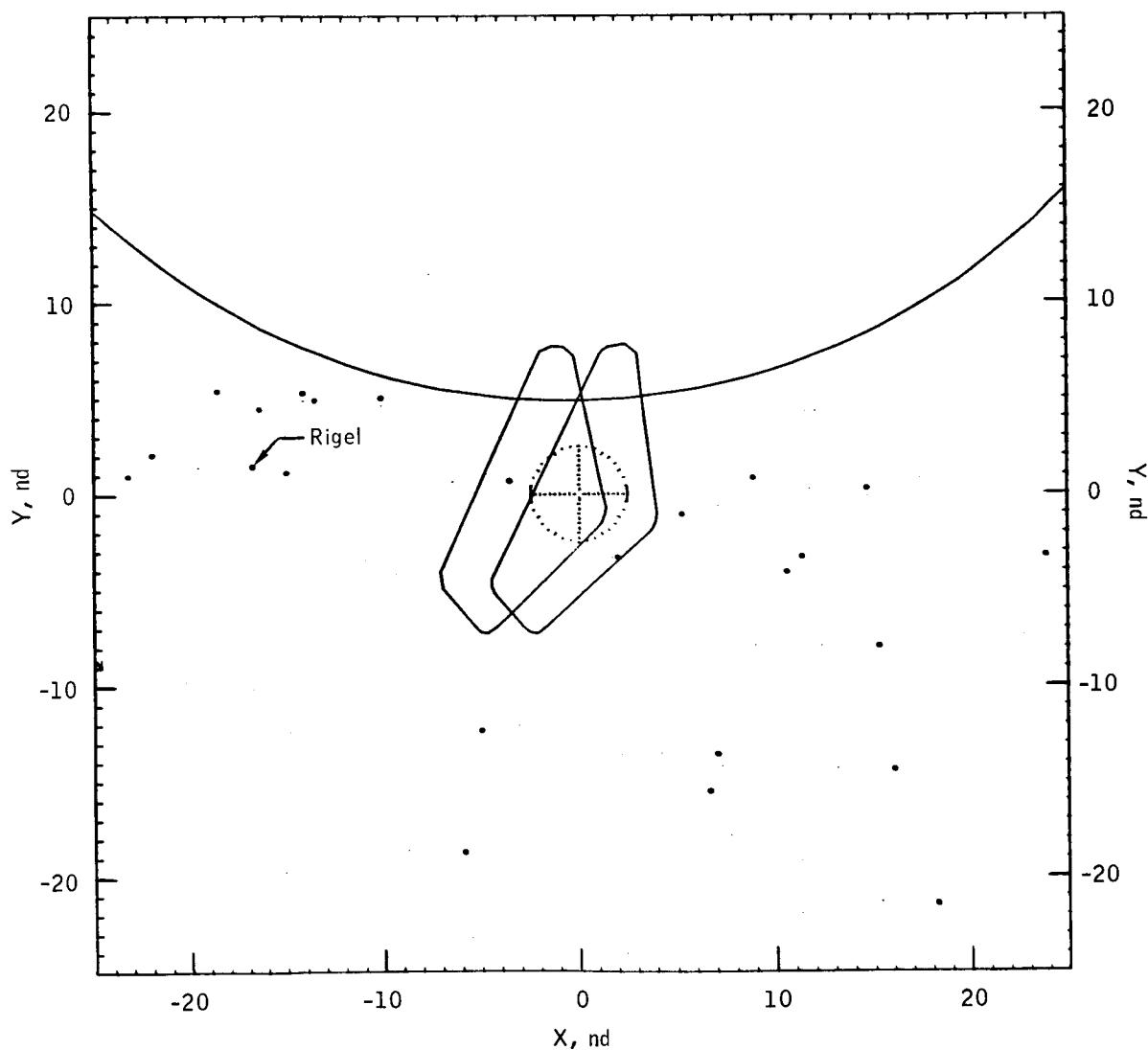


Figure 31c.- Launch date December 21, 1968; 72° launch azimuth; second opportunity.
End of L01 burn.

109

SEQ	4	22	31	41	47	63	73	75	80	108	111	112	120
X	16	22	22	13	21	4	12	4	-8	-7	7	8	12
Y	-22	-8	-5	-16	-4	-17	-9	-15	-20	-13	-5	-5	-1

SEG	144	150	151	186	205	207	215	221	222	230	231	237
X	0	2	6	-6	1	6	-17	-14	7	-12	-1	-16
Y	-5	-2	-1	0	3	5	0	0	6	3	6	3

SEQ	239	245	246	248	252	256	265	270	271	281
X	-24	-18	-16	-5	-17	-21	-12	6	2	-5
Y	1	3	4	6	4	4	7	10	10	11

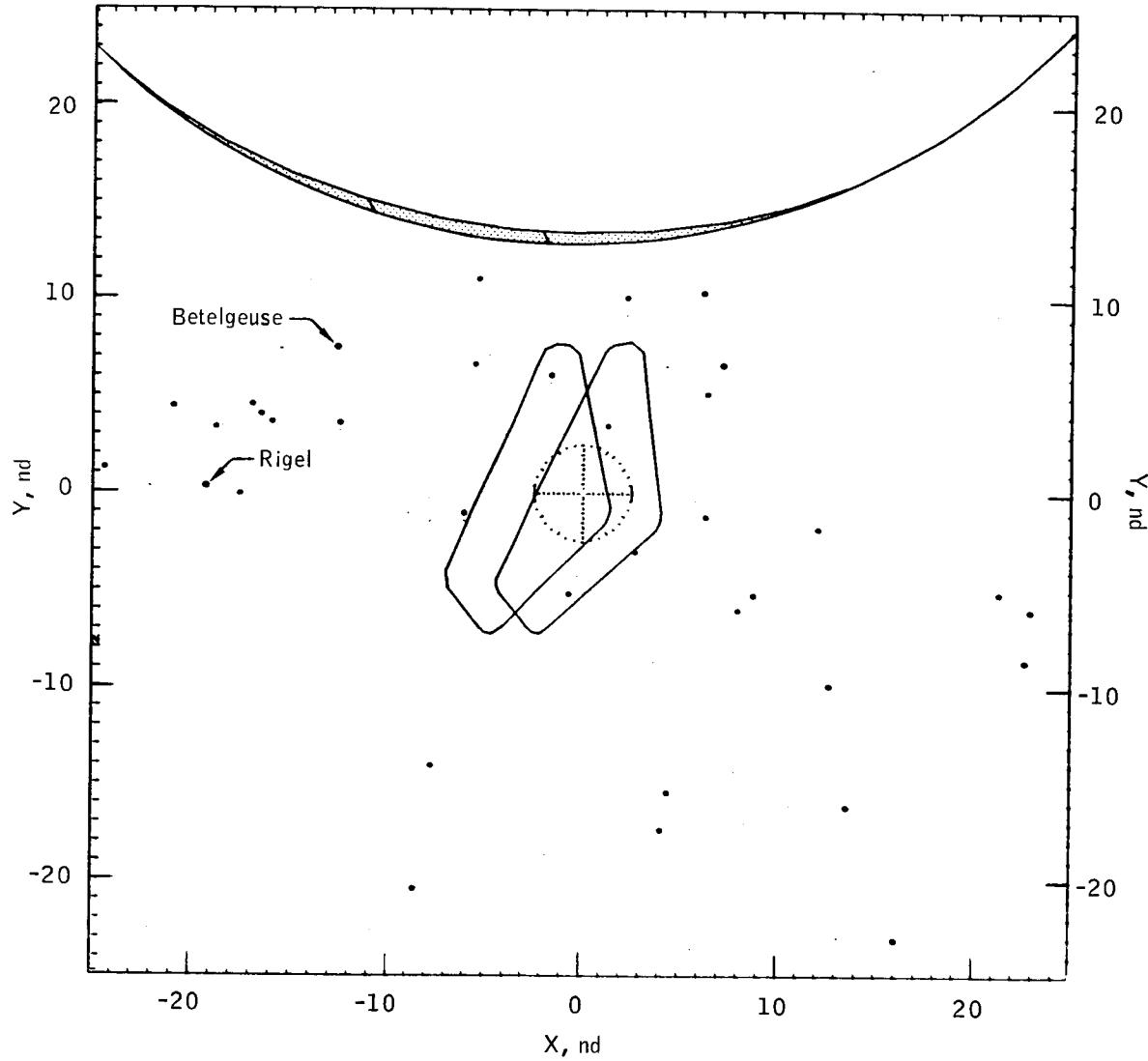


Figure 32a.- Launch date December 21, 1968; 108° launch azimuth; second opportunity.
Beginning of LOI burn.

110

SEQ	4	22	31	41	47	63	73	75	80	108	111	112	120
X	17	23	23	14	22	5	13	5	-7	-6	8	9	13
Y	-22	-8	-5	-15	-4	-17	-9	-15	-20	-13	-5	-4	-1

SEG	144	150	151	186	205	207	215	221	222	230	231	233
X	0	3	7	-5	2	7	-16	-18	8	-11	0	-24
Y	-4	-2	0	0	3	6	0	0	7	3	6	0

SEQ	237	239	245	246	248	252	258	265
X	-15	-23	-17	-15	-4	-16	-20	-11
Y	3	1	3	4	6	4	4	7

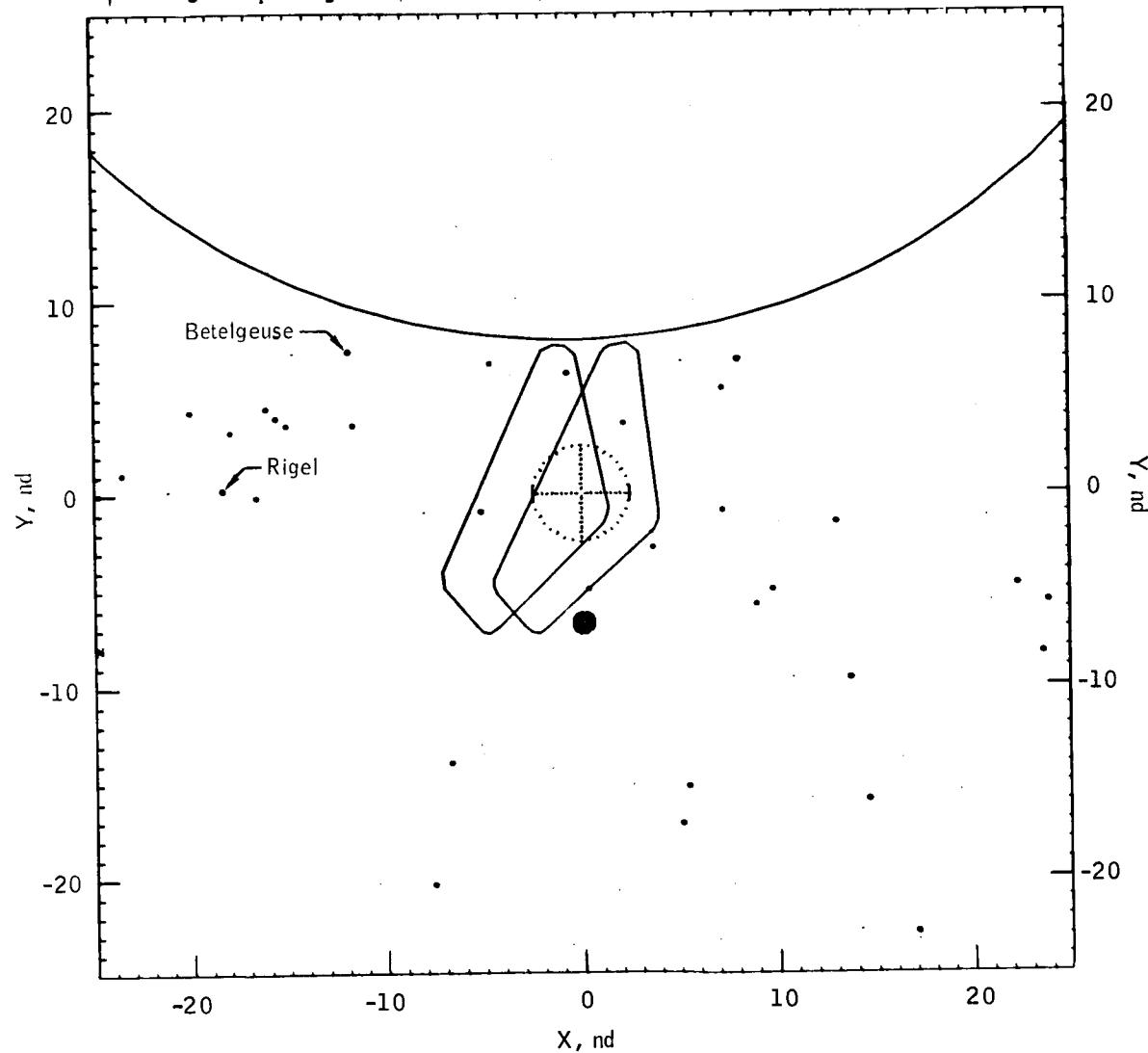


Figure 32b.- Launch date December 21, 1968; 108° launch azimuth; second opportunity.
Middle of LOI burn.

SEQ	4	41	47	63	73	75	80	108	111	112	120	144	150
X	18	16	24	7	15	7	-5	-4	10	11	14	2	5
Y	-22	-15	-4	-16	-9	-14	-19	-13	-5	-4	0	-4	-2

SEQ	151	186	205	215	221	230	233	237	239	245	246	252	256
X	9	-3	4	-14	-16	-9	-22	-13	-21	-16	-13	-14	-18
Y	0	0	4	0	0	3	0	3	1	3	4	4	4

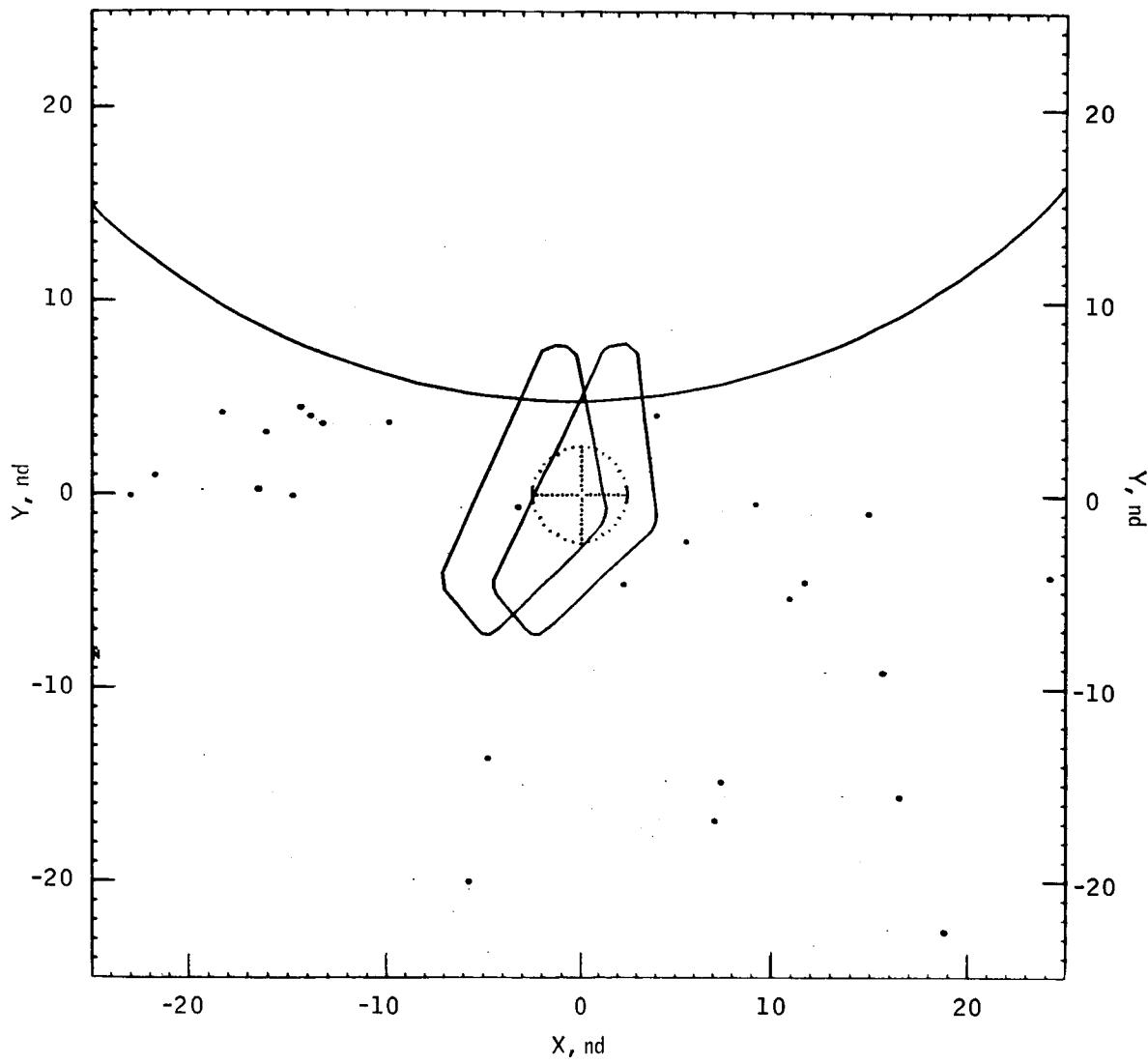


Figure 32c. - Launch date December 21, 1968; 108° launch azimuth; second opportunity.
End of LOI burn.

SEQ	349	356	362	441	473	480	507	509	515	535	540	577	580
X	2	-12	0	-14	-3	1	19	21	4	3	20	24	17
Y	-22	-18	-20	-3	-2	-2	-6	-7	2	8	-2	0	7

SEG	604	619
X	24	24
Y	6	13

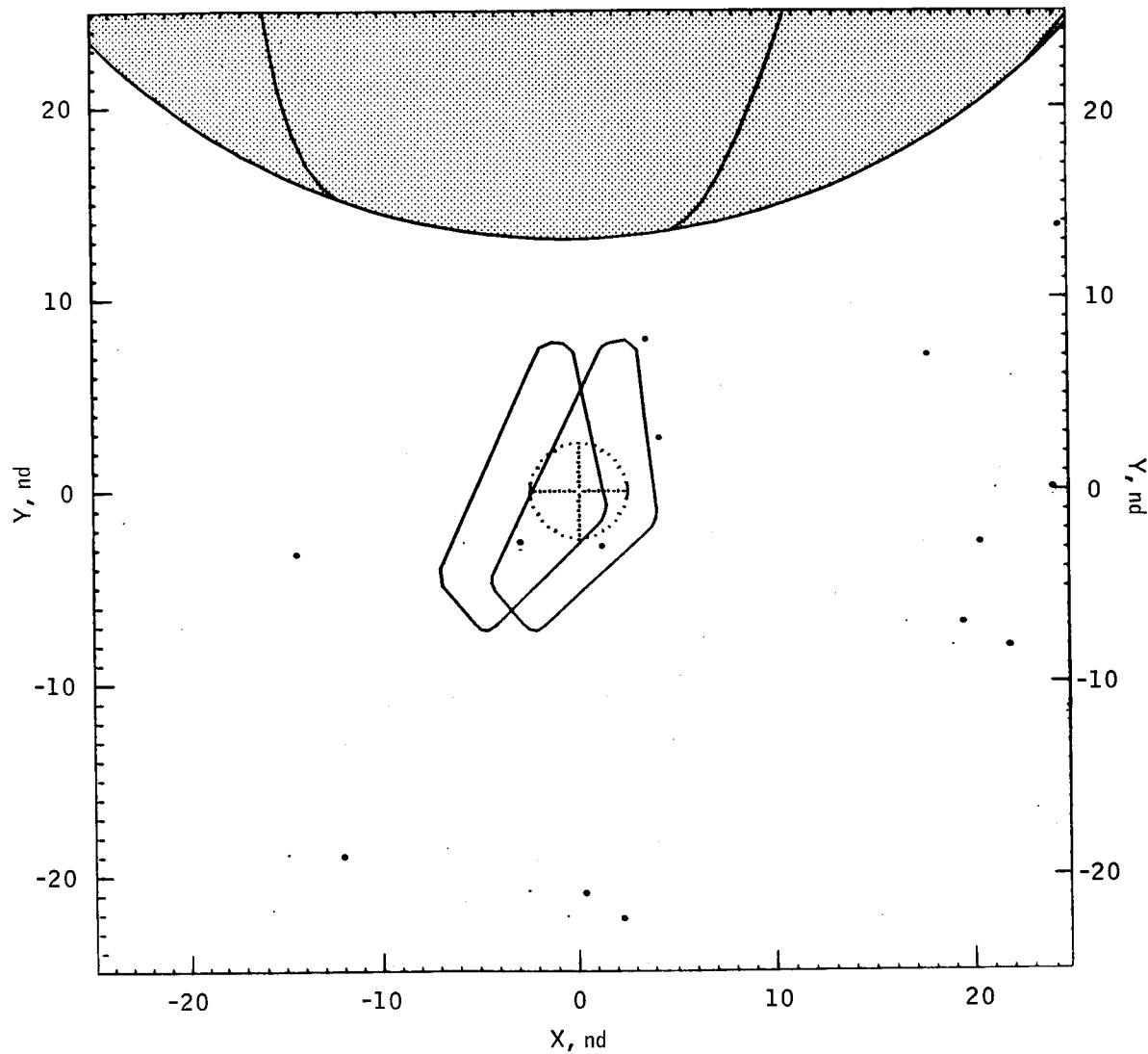


Figure 33a.- Launch date December 27, 1968; 72° launch azimuth; second opportunity.
Beginning of L01 burn.

SEQ	308	349	356	362	377	440	473	480	507	509	515	535	540	577	580
X	-24	2	-11	1	-24	-13	-2	1	20	22	4	4	21	24	18
Y	-19	-21	-17	-19	-8	-2	-1	-1	-5	-6	3	8	-1	1	8

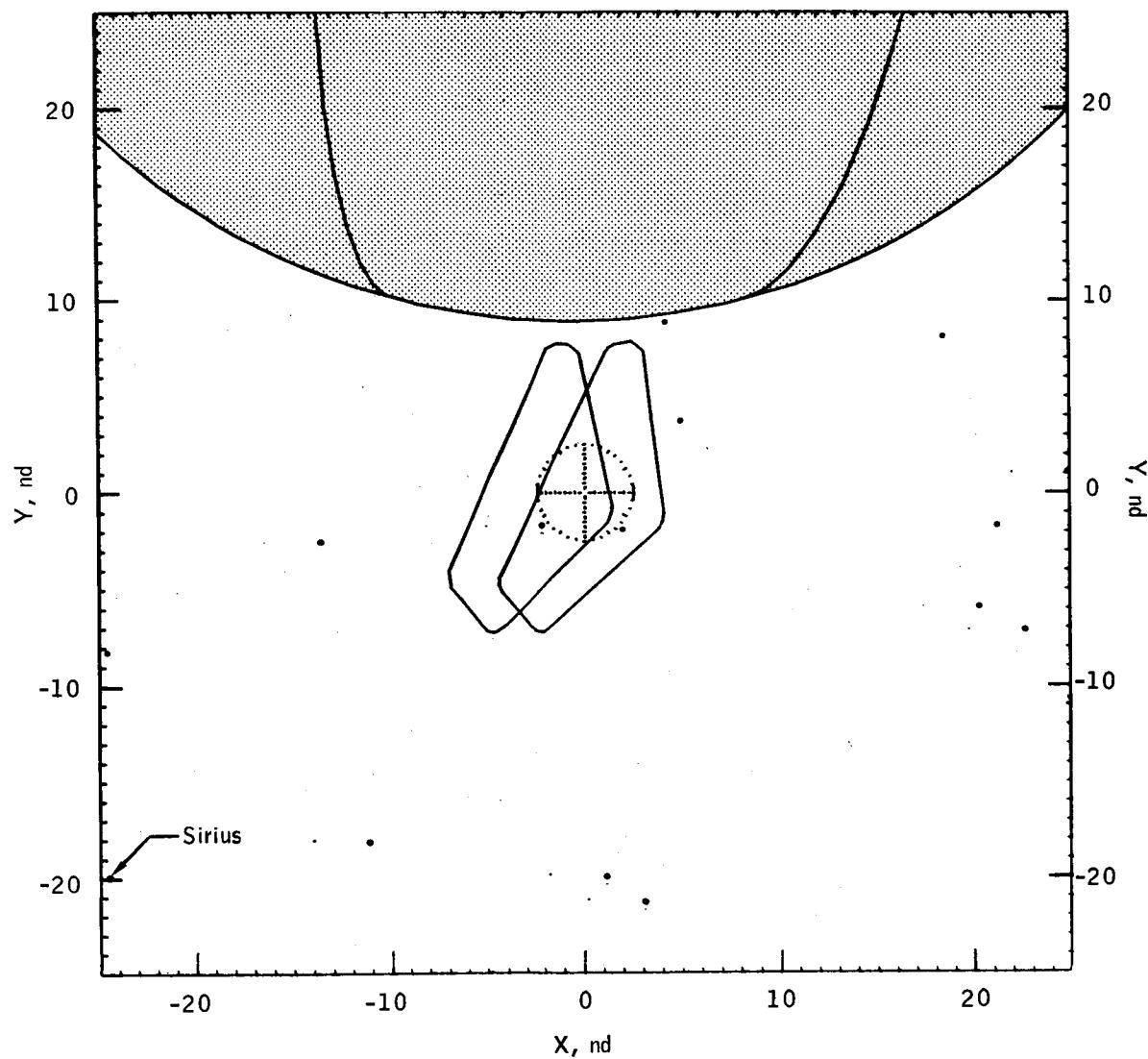


Figure 33b.- Launch date December 27, 1968; 72° launch azimuth; second opportunity.
Middle of LOI burn.

SEQ	290	308	349	355	342	377	440	473	480	507	509	515	540
X	-24	-22	4	-7	2	-23	-12	0	3	21	23	6	22
Y	-21	-19	-20	-16	-13	-7	-1	0	0	-4	-5	5	0

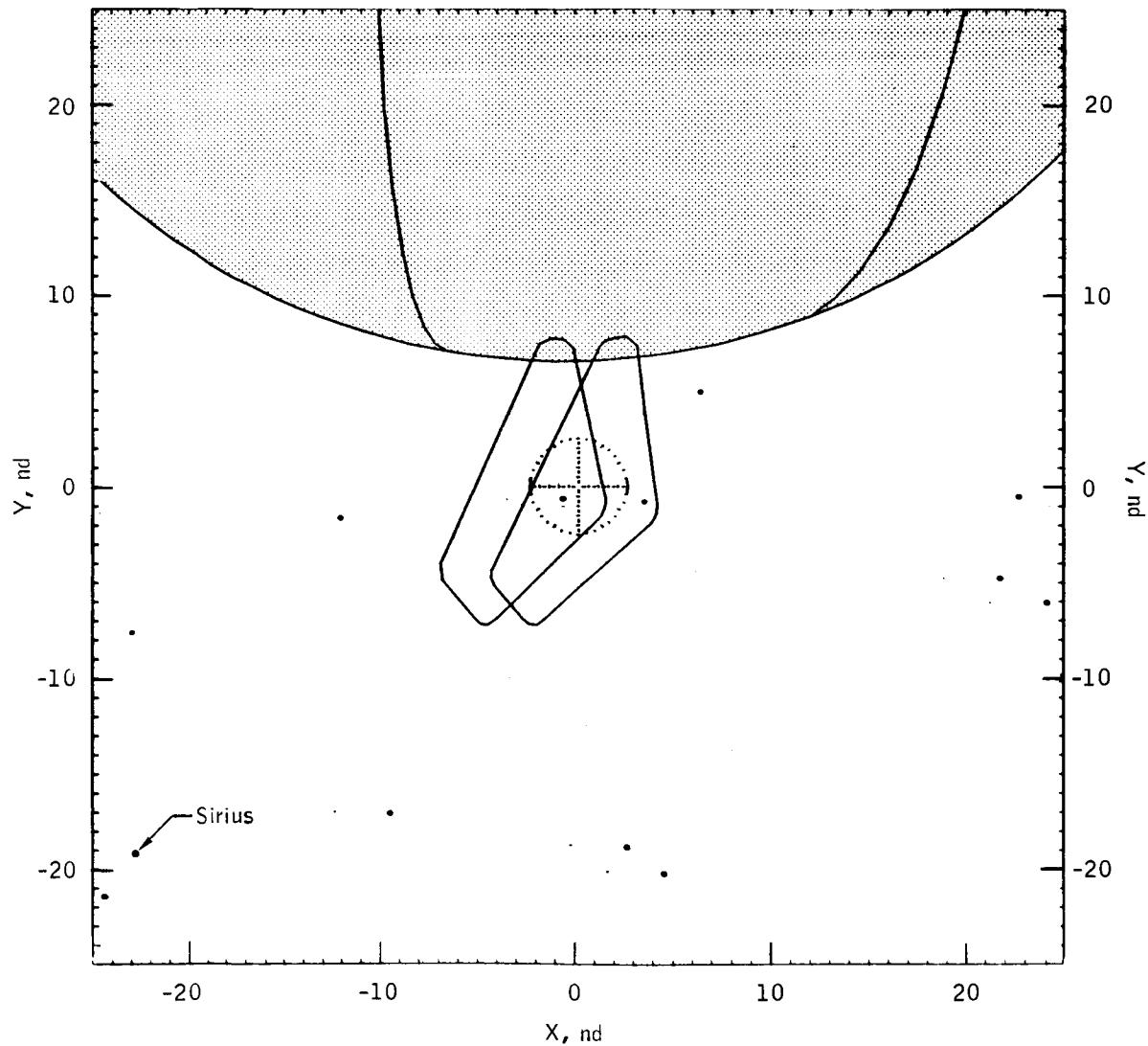


Figure 33c.- Launch date December 27, 1968; 72° launch azimuth; second opportunity.
End of LOI burn.

SEQ	349	356	362	440	473	480	507	509	515	535	540	577
X	2	-12	0	-14	-3	0	19	21	3	3	20	23
Y	-22	-19	-21	-3	-3	-3	-7	-8	2	7	-3	0

SEG	580	592	604	639
X	17	24	24	23
Y	6	1	5	13

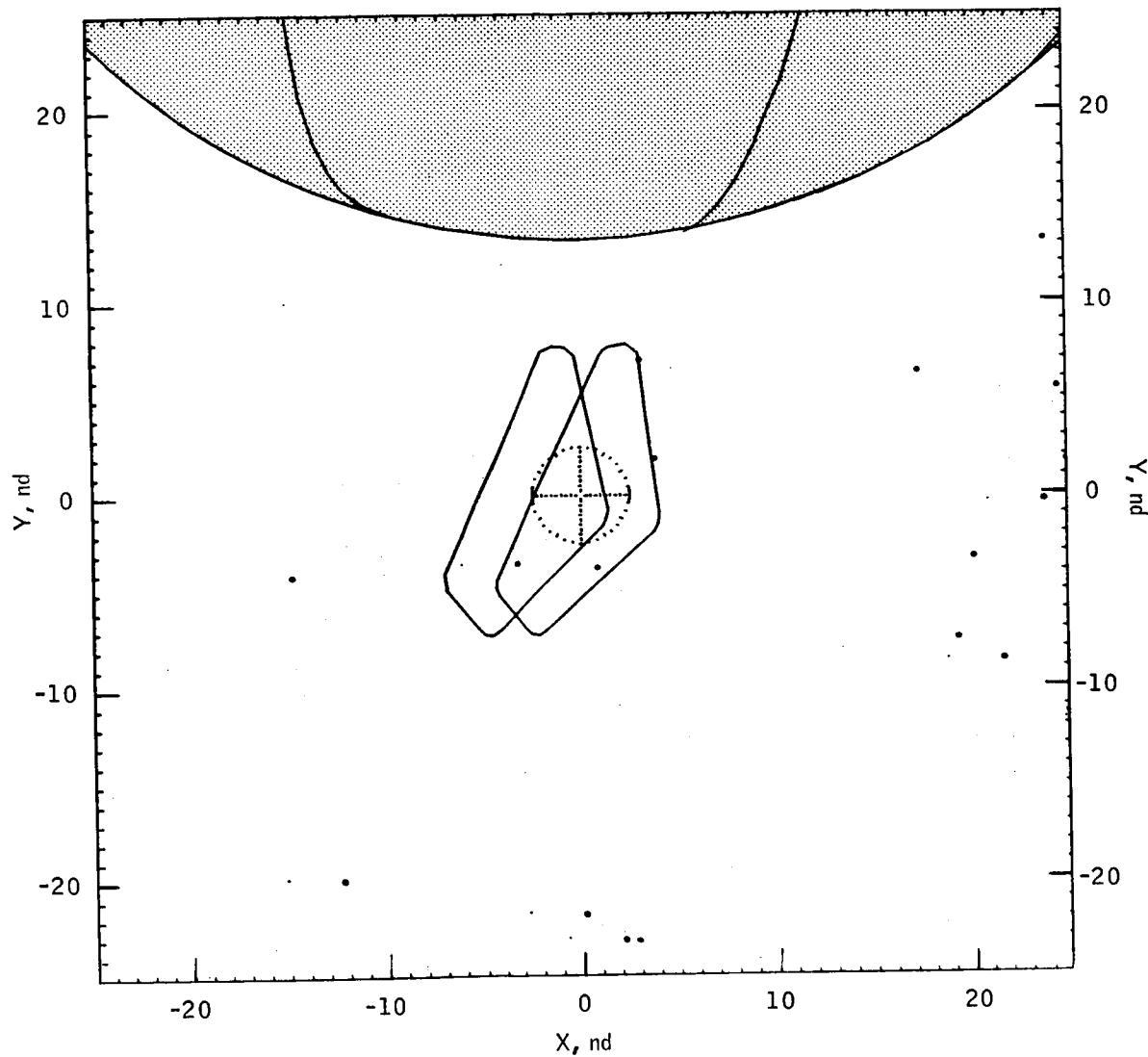


Figure 34a.- Launch date December 27, 1968; 108° launch azimuth; second opportunity.
Beginning of LOI burn.

SEQ	349	356	362	447	473	480	507	509	515	535	540	577	580
X	2	-11	0	-14	-2	1	19	22	4	3	20	24	17
Y	-22	-19	-20	-3	-2	-2	-6	-7	2	7	-2	0	7

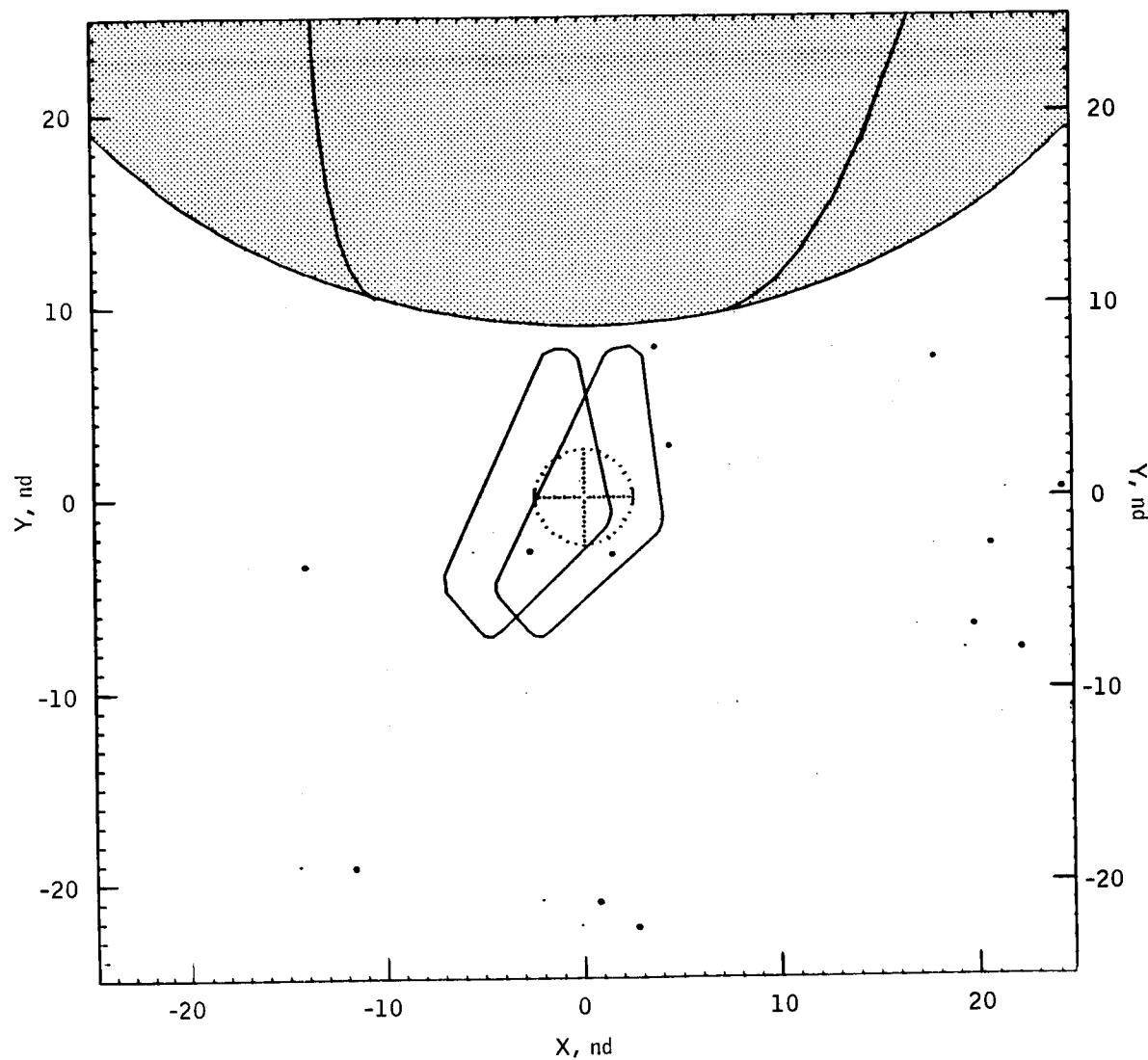


Figure 34b.- Launch date December 27, 1968; 108° launch azimuth; second opportunity.
Middle of LOI burn.

SEQ	308	349	356	362	377	440	473	480	507	509	515	548
X	-24	3	-10	1	-24	-13	-1	2	20	23	5	21
Y	-20	-21	-18	-19	-8	-2	-1	-1	-5	-6	3	-1

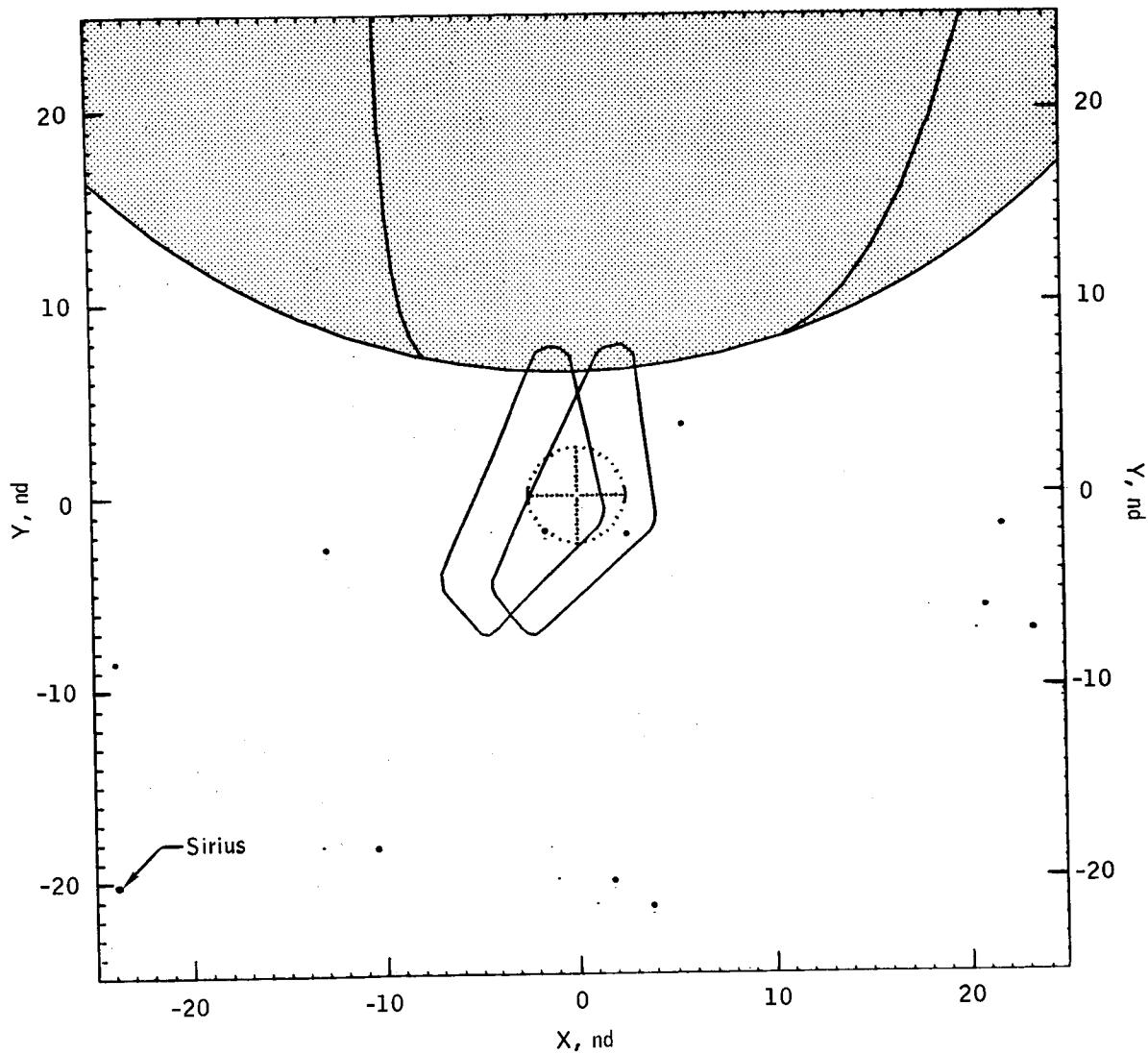


Figure 34c.- Launch date December 27, 1968; 108° launch azimuth; second opportunity.
End of LOI burn.

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